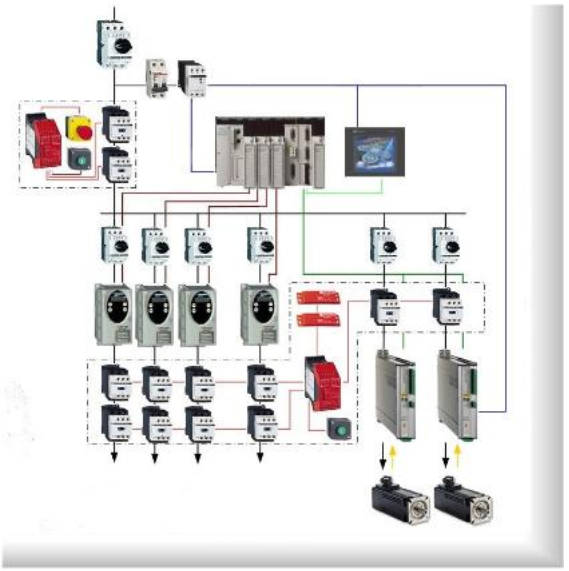
Premium Lexium
Altivar Sercos
System User Guide
[source code]



Preferred Implementation:
Compact High Performance

33003612.00

Merlin Gerin
Square D
Telemecanique

Schneider Electric
Building a New Electric World

Mar 2006

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Introduction

This document is intended to provide a quick introduction to the described System.
It is not intended to replace any specific product documentation. On the contrary, it offers additional information to the product documentation, for installing, configuring and starting up the system.

A detailed functional description or the specification for a specific user application is not part of this document. Nevertheless, the document outlines some typical applications where the system might be implemented.

Abbreviations

Word / Expression	Signification
AC	Alternating Current
Advantys	SE product name for a family of I/O modules
Altivar (ATV)	SE product name for a family of VSDs
CANopen	Name for a communications maschine bus system
CB	Circuit Breaker
CoDeSys	Hardware-independant IEC 61131-3 programming software
ConneXium	SE product name for a Family of Transparent Factory devices
DC	Direct Current
EDS	Electronic Data Sheet
E-OFF, E-STOP	Emergency Off switch
Harmony	SE product name for a family of switches and indicators
HMI	Human Machine Interface
I/O	Input/Output
IclA (ICLA)	SE product name for a compact drive
Lexium/Lexium05/LXM	SE product name for a family of servo-drives
Magelis	SE product name for a family of HMI-Devices
MB - SL	SE name for a serial Modbus communications protocol
Micro	SE product name for a middle range family of PLCs
NIM	SE product name for a Network Interface Module
PC	Personal Computer
Phaseo	SE product name for a family of power supplies
PLC	Programmable Logic Computer
Powersuite	An SE software product for configuring ALTIVAR drives
Premium	SE product name for a middle range family of PLCs
Preventa	SE product name for a family of safety devices
PS1131 (CoDeSys)	SE Product name for PLC programming software with CoDeSys
PS	Power Supply
SE	Schneider Electric
Sycon	SE product name of a Field bus programming software
Telefast	SE product name for a series of distributed I/O devices
Tesys U	SE product name for a decentralised I/O System
Twido	SE product name of a middle range family of PLCs
TwidoSoft	SE product name for a PLC programming software
Unity (Pro)	SE product name for a PLC programming software
Vijeo Designer	An SE software product for programming Magelis HMI devices
VSD	Variable Speed Drive
WxHxD	Dimensions : Width, Height and Depth
XBT-L1000	An SE software product for programming Magelis HMI devices

Application Source Code

Introduction

Examples of the source code and wiring diagrams used to attain the system function as described in this document can be downloaded from our „Village“ website under **this** link.

The example source code is in the form of configuration, application and import files. Use the appropriate software tool to either open or import the files.

Using the Example Software

The example software includes a UniLink project for configuring the Lexium17, a Unity Pro project for the PLC and a Vijeo project for the HMI. Please note:

- The communication interface must be switched to **Offline** in order to use the configuration data for Lexium17 with the UniLink software. Once this has been done, the configuration files (file name *.l17) can be opened. One file has been provided for each drive.
- The Unity project is an import file, which can be opened by selecting **File->Open** and the file type *.xef.
- The Vijeo project is an import file, which can be opened by selecting **File->Import/Export** and the file type *.vdz.

Extension	File Type	Software Tool Required
AIW	Configuration File	Advantys
CNF	**C**onfiguratio**n** **F**ile	Sycon
CO	**C**AN**o**pen definitions file	Sycon
CSV	**C**omma **S**eperated **V**alues, Spreadsheet	Twidosoft
CTX		Unity
DCF	**D**evice **C**onfiguration **F**ile	Advantys
DIB	**D**evice **I**ndependent **B**itmap	Sycon
DOC	**Doc**ument file	Microsoft Word
DOP	Project File	Magelis XBTL
EDS	**E**lectronic **D**ata **S**heet – Device Definition	Industrial standard
FEF	Export file	PL7
GSD	EDS file (**G**eraete **S**tamm **D**atei)	Profibus
ISL	**Isl**and file, project file	Advantys
PB	**P**rofi**b**us definitions file	Sycon
PDF	**P**ortable **D**ocument **F**ormat - document	Adobe Acrobat
PRO	Project File	PS1131 - CoDeSys
PS2	Export file	Powersuite export file
RTF	**R**ich **T**ext **F**ile - document	Microsoft Word
STU	Project file	Unity studio
STX	Project file	PL7
TLX	Project file	Twinline control tool
TWD	Project file	TwidoSoft
VDZ	Project file	Vijeo Designer
XEF	Export file	Unity Pro
ZM2	Project File	Zeliosoft

Typical Applications

Introduction

Here you will find a list of the typical applications, and their market segments, where this system or subsystem can be applied:

- Medium- and large-scale packaging machines
- Machines for processing materials such as metal, wood, etc.
- Medium- and large-scale textile machines
- Applications in the printing industry
- Assembly and production of devices

Application	Description	Image
Packaging machines	Used for controlling various packaging machines, for example, in this case, a palletizer for stacking goods on a pallet. The drives need to be able to perform the following tasks: • Lift layers of jars • Position layers • Transport pallets • Transport jars	
Textile machines	Used for controlling transport machines, folding and cutting machines with several drives, which need to be able to meet a variety of requirements, for example, positioning, transport, etc.	
Device manufacture	Used for controlling machines for assembling the various components of a device, for example, in this case, for gluing skins into control cabinet doors. The drives are responsible for transport, positioning and pumping.	

System

Introduction

The system chapter describes the architecture, the dimensions, the quantities and different types of components used within this system.

Architecture

General

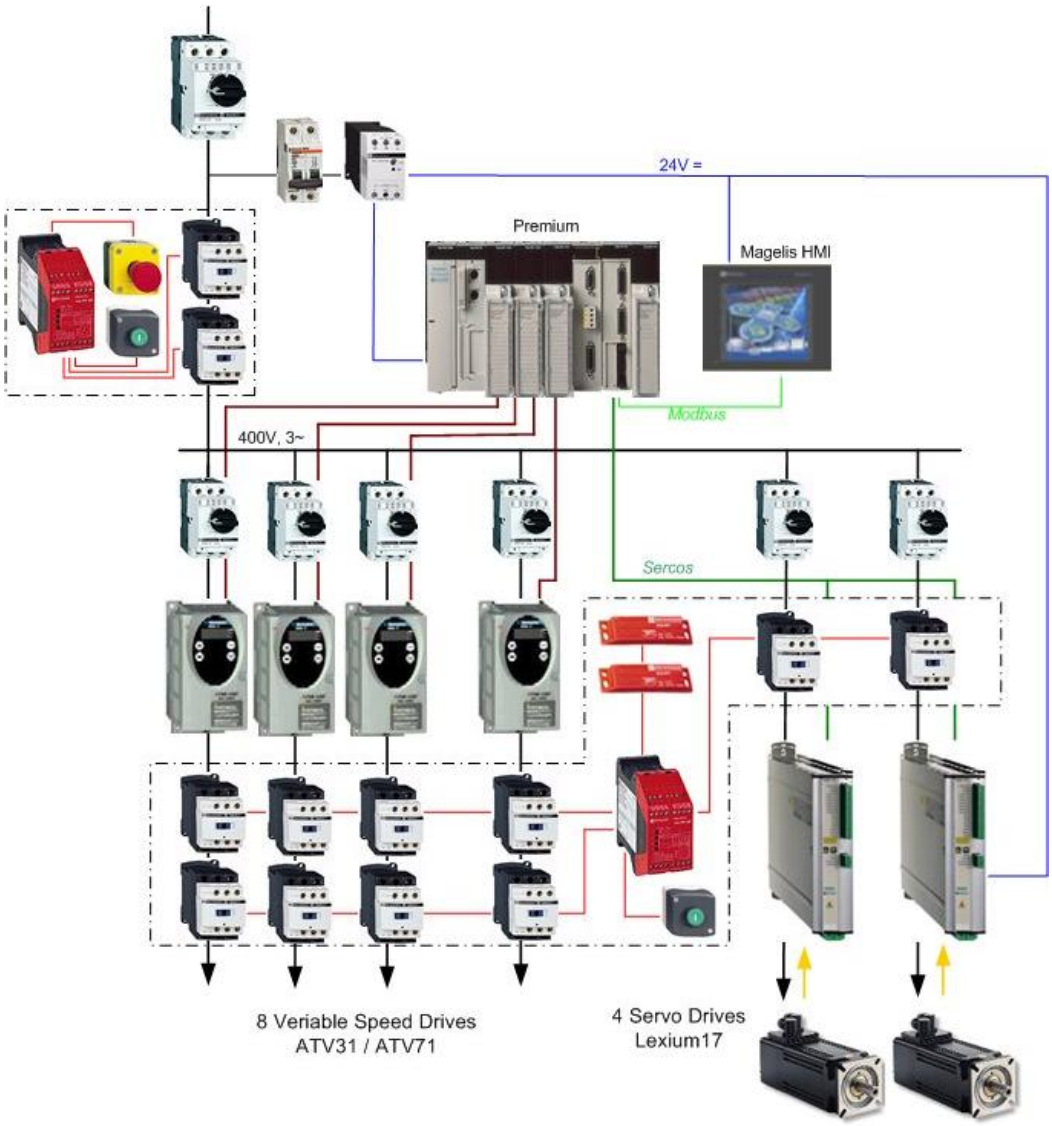
The system comprises of a load component, a safety component and a control component.

The load component is responsible for various requirements in respect of the drives, with the result that a variety of types of variable speed controller (ATV31 and ATV71) and servo drives are used. A single-phase or three-phase 400 V or 230 V AC power supply is used; appropriate motor circuit breakers are provided. There is also a 24 V DC power supply for the various control units (servos, safety, PLC, etc.).

The safety component comprises two Category 4 safety circuits for an emergency-off shutdown and for monitoring doors. As well as door safety being an option, the drives can be assigned to different safety circuits for the purpose of door monitoring.

The control system comprises a PLC with central acquisition of the various input and output data. In the case of the variable speed drives, the drives are linked to the control system via I/O signals, whereas the Sercos bus is used for the servo controllers. It also features a graphic display terminal (XBGT HMI) that communicates with the PLC using the Unitelway protocol and is used for plant control.

Layout


24V =
Premium
Magelis HMI
Modbus
400V, 3~
Sercos
8 Veriable Speed Drives
ATV31 / ATV71
4 Servo Drives
Lexium17

Components

Hardware:

- Master switch (NSC100 Compact)
- 24 V power supply (Phaseo, 20 A)
- ATV31 and ATV71 variable speed drives
- Lexium17 drive controller incl. motors (servo)
- Motor circuit breaker (GV2)
- Category 4 safety modules (Preventa)
- Emergency-off switch (XALK) and position switch (XCSA)
- Contactors (LC1D)
- Standard AC motor (7x)
- Control system (PLC) incl. I/O cards (TSX Premium)
- Graphic display terminal (Magelis XBTG)

Software:

- Unity Pro 2.1 (PLC)
- Vijeo Designer 4.2.0 (HMI)
- UniLink 3.00 (Lexium17)
- PowerSuite 2.0 (ATV31) (if applicable)

Quantities of Components

The number of components needed to meet the requirements of the solution outlined in this document will vary. A detailed list of the required components, including quantities and part numbers, can be found in the Appendix to this document.

Degree of Protection

Not all the components in this configuration are designed to withstand the same environmental conditions. Some components may need additional protection, in the form of housings, depending on the environment in which you intend to use them. For environmental details of the individual components please refer to the list in the appendix of this document and the appropriate user manual.

Technical Data

Supply voltage	400 V AC
Total supply output	~ 13 kW
Speed drive rated powers	4x 0.37 kW, 3x 0.75 kW, 4x ~1.6 kW
Motor brake	Not fitted
Connector cross-section	5x 2.5 mm² (L1, L2, L3, N, PE)
Safety category	Cat. 4 (emergency off and optional door monitoring)

Safety Notice

The standard and level of safety you apply to your application is determined by your system design and the overall extent to which your system may be a hazard to people and machinery.

In this application example, Category 4 (according to EN 954-1) has been selected for the purpose of ensuring safety. It is not possible to make a general statement in respect of the safety or control category required for an application group. A detailed analysis of risks and hazards must be carried out and as such requires the involvement of an actual machine.

Whether or not the above safety category should be applied to your system should be ascertained with a proper risk analysis.

This document is not comprehensive for any systems using the given architecture and does not absolve users of their duty to uphold the safety requirements with respect to the equipment used in their systems or of compliance with either national or international safety laws and regulations

Size/ Dimensions

The dimensions of the devices used, e.g., the PLC, variable speed drive and power supply, support installation inside a control cabinet measuring 1200x1800x600 mm (WxHxD).

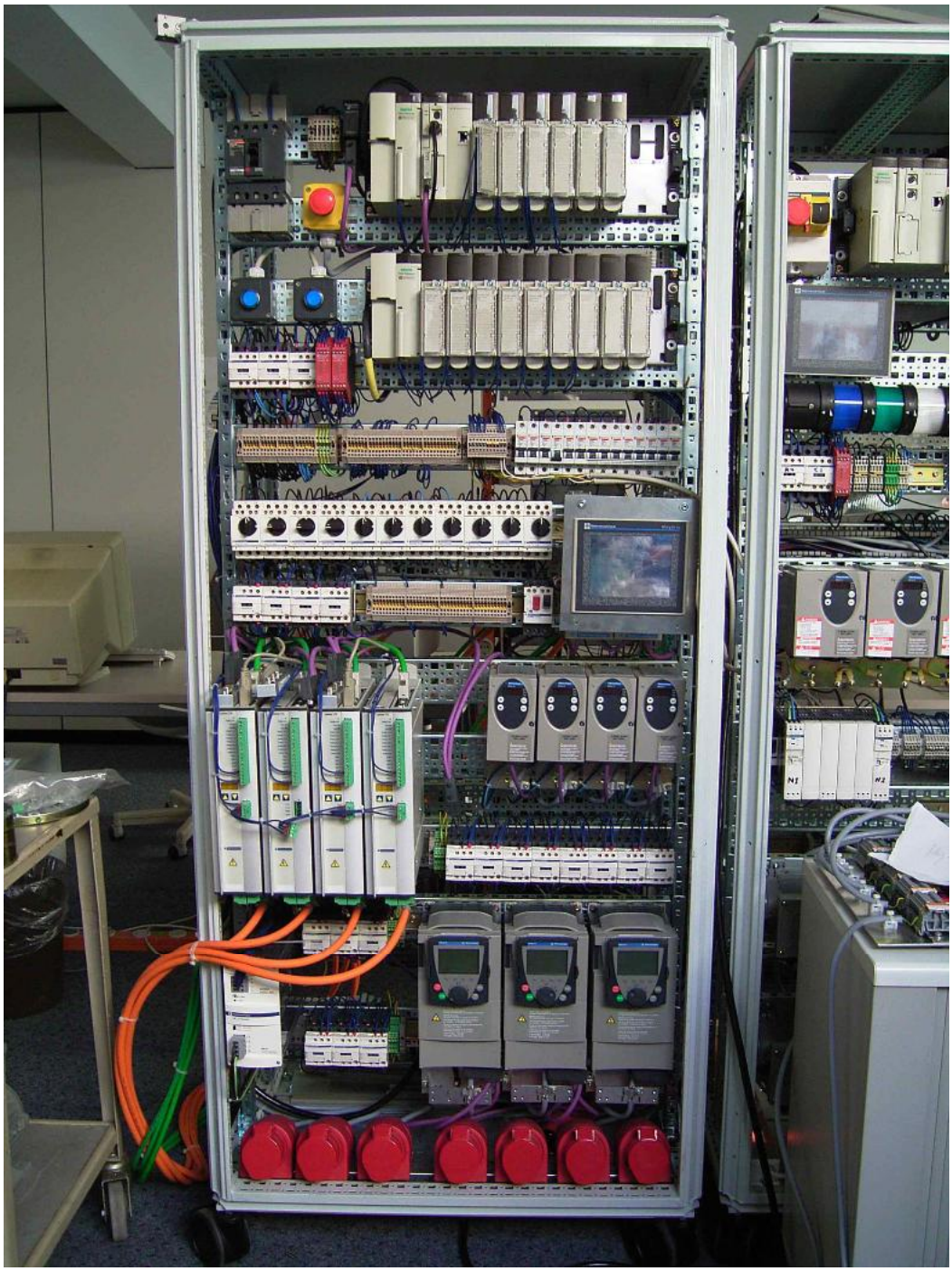
Moreover, the graphic display terminal, the display elements used to indicate a "group error", "emergency-off acknowledgment" and "door-safety acknowledgment" can be built into the door of the control cabinet along with the emergency-off switch.

Installation

Introduction

This chapter describes the steps necessary to set up the hardware and configure the software required to fulfil the described function of the application.

Layout



Notes

The programming of this application can be used as a basis for plant and machinery needing a larger number of drives with a whole range of different requirements and acquiring their input and output data locally via the PLC. The motors are controlled independently by the PLC via I/O signals or, in the case of the servo drives, via the Sercos bus.

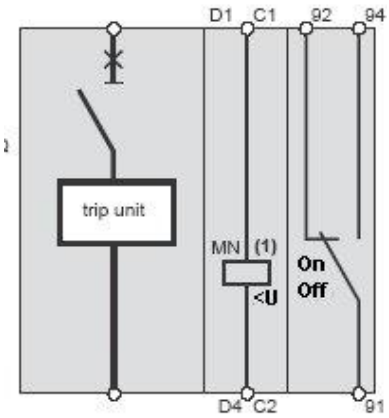
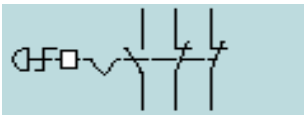
The components listed in the next chapter represent a selection of the components required. In particular, the number of motors used and their allocation to variable speed drives and servos are determined by the relevant application (the number of inputs and outputs may also vary).

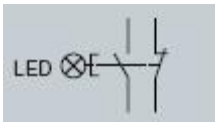
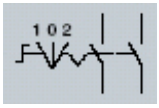
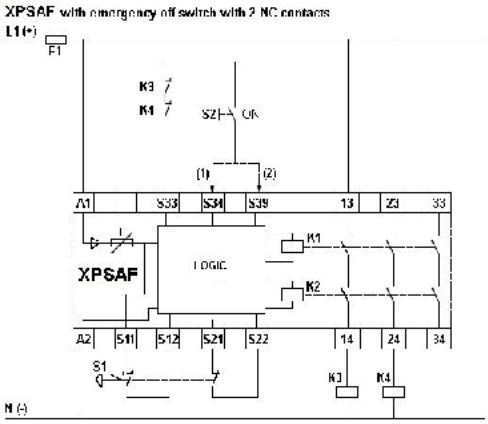
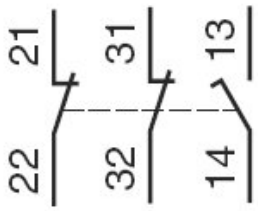
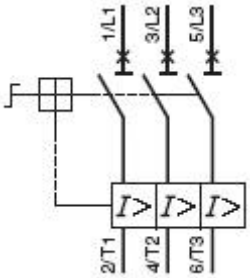
Safety Category 4, which is suggested here as one possible option, is not necessarily binding/not necessarily required for every application, as a risk analysis must be produced and verified for each system (in accordance with national and/or international standards and regulations).

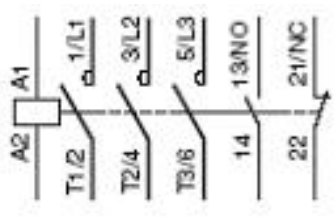
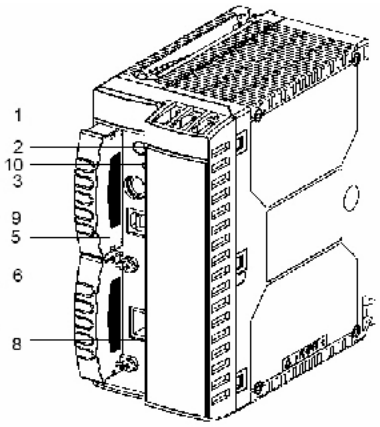
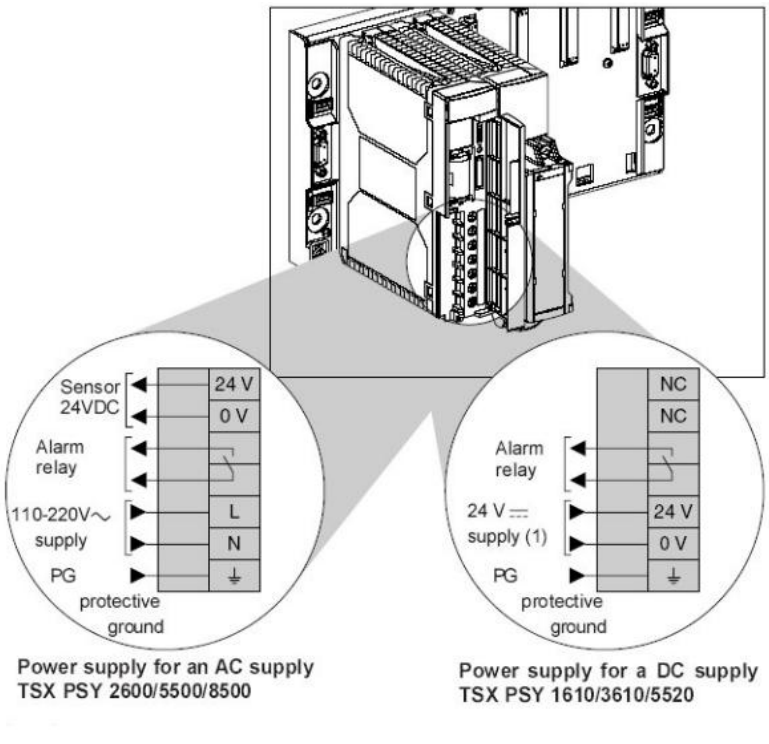
Hardware

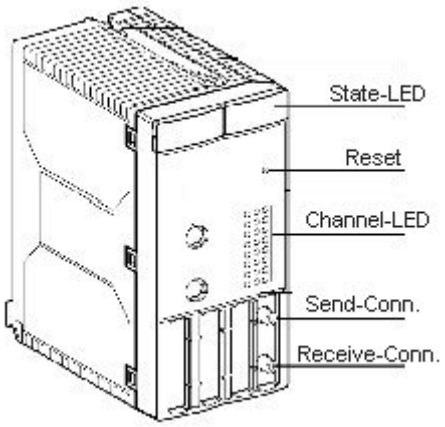
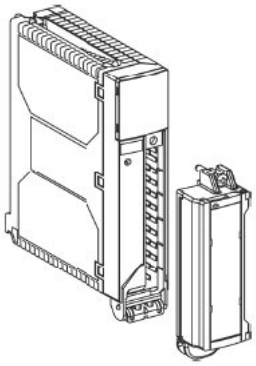
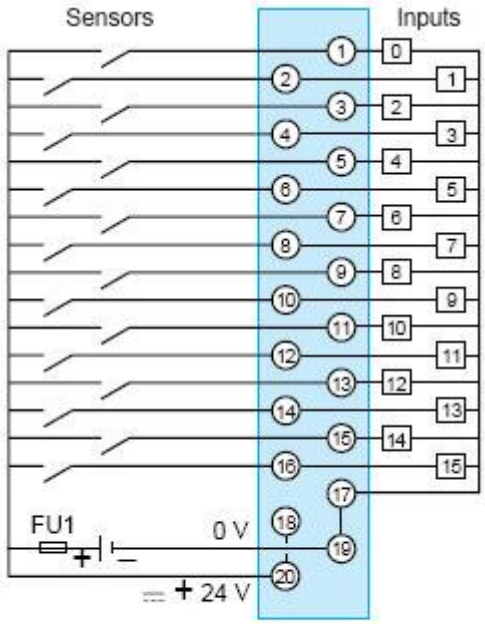
General

- The components designed for installation in a control cabinet, i.e., safety modules, line circuit breakers, contactors, and motor circuit breakers, can be snapped onto a 35 mm top-hat rail.
- The master switch, Premium PLC, Phaseo power supply unit, and Altivar variable speed drive are screwed directly onto the mounting plate. If you are using the Altivar 31, these components can also be snapped onto a top-hat rail using an adapter.
- The emergency-off and door-safety switches, as well as the housing for display and acknowledge indicators, are designed for backplane assembly in the field; with the exception of the door-safety switch, all switches can also be installed directly in a control cabinet (e.g., in cabinet door) without their enclosing housings.
- There are two options for installing XB5 pushbuttons or indicator lamps: These pushbuttons or switches can be installed either in a 22 mm hole, e.g., drilled into the front door of the control cabinet, or in an XALD-type housing suitable for up to 5 pushbuttons or indicator lamps. The XALD pushbutton housing is designed for backplane assembly or direct wall mounting.
- The individual components must be interconnected in accordance with the detailed circuit diagram in order to ensure that they function correctly.
- In addition to the wiring for the power circuits, the I/O signals are wired between the PLC and the variable speed drives and a Sercos ring circuit installed between the PLC and the servo controllers.

Mains switch **NSC 100 Compact**		
EMERGENCY OFF **switch** **XALK178G**		

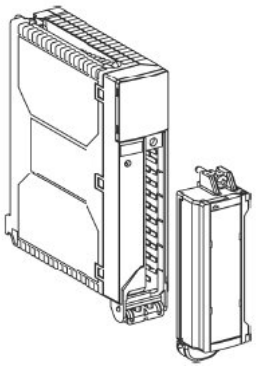
	Selector and Pushbutton Switch **XB5**	 	 
	Safety Module Category 4 **XPSAF5130**		
	Safety Switch Door safety **XCSA703**		
Motor Circuit Breaker	**Motor Circuit Breaker** **(short-circuit protection)** **GV2-L**		

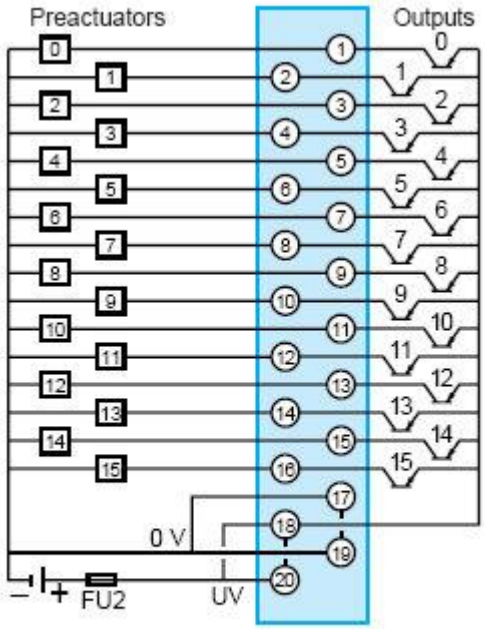
Motor Contactors **LC1D**		
Premium PLC Processor **TLX P57 3634M**		
	1 Display LEDs 2 Eject button for PCMCIA-SRAM card 3 Terminal port (TER) 5 Slot for a memory expansion card (PCMCIA) 6 Slot for a communication card (PCMCIA) 8 RJ45 connector for Ethernet connection 9 USB port 10 RESET button	
Premium PLC Power Supply **TSX PSY 3610**		

Premium PLC Sercos Bus **TSX CSY 84**		
Premium PLC I/O cards **TSX DEY16D2**		

Premium PLC I/O cards

TSX DSY16T2

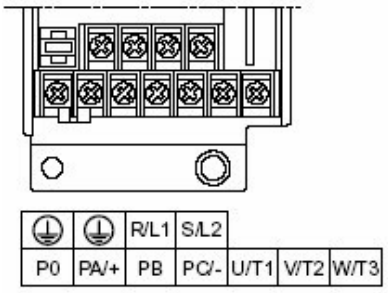




UV : ⎓ 24 V for TSX DSY 16T2
FU2 : fast-blow fuse
6.3 A for TSX DSY 16T2

ATV31 Drive Control

ATV31H037M2 incl. supply and motor connection



⏚	⏚	R/L1	S/L2			
P0	PA/+	PB	PC/-	U/T1	V/T2	W/T3

ATV31 Drive Control

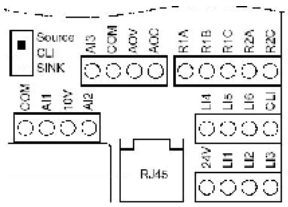
Terminal description

Terminal	Function
⏚	Ground terminal
R/L1 S/L2	Power supply
R/L1 S/L2 T/L3	
PO	DC bus + polarity
PA/+	Output to braking resistor (+ polarity)
PB	Output to braking resistor
PC/-	DC bus - polarity
U/T1 V/T2 W/T3	Outputs to the motor

ATV31 Drive Control

Control terminals

(I/O signals)



Terminal	Function
R1A R1B R1C	Common point C/O contact (R1C) of programmable relay R1
R2A R2C	N/O contact of programmable relay R2
COM	Analog I/O common
AI1	Analog voltage input
10 V	Power supply for setpoint potentiometer 1 to 10 kΩ
AI2	Analog voltage input
AI3	Analog current input
COM	Analog I/O common
AOV AOC	Analog voltage output AOV or Analog current output AOC
24 V	Logic input power supply
LI1 LI2 LI3	Logic inputs
LI4 LI5 LI6	Logic inputs

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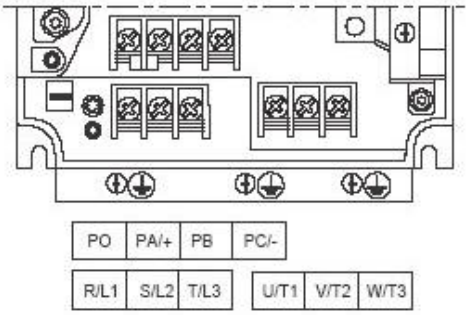
ATV71 Drive Control

ATV31H018M2 incl. supply and motor connection



ATV71 Drive Control

Terminal description

Terminal	Function
⏚	Protective ground connection terminal
R/L1 S/L2 T/L3	Power supply
PO	DC bus + polarity
PA/+	Output to braking resistor (+ polarity)
PB	Output to braking resistor
PC/-	DC bus - polarity
U/T1 V/T2 W/T3	Outputs to the motor

ATV71 Drive Control

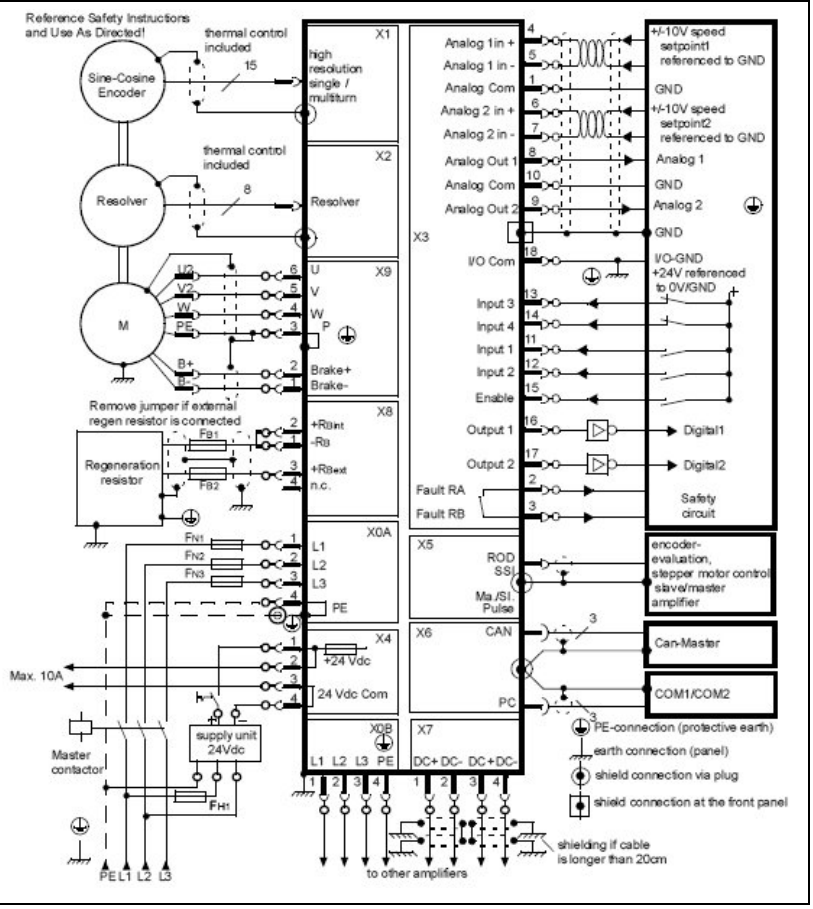
Control terminals

(I/O signals)

Characteristics and functions of the control terminals

Terminal	Function	Electrical characteristics
R1A R1B R1C	Common point C/O contact (R1C) of programmable relay R1	• Minimum switching capacity: 3 mA for 24 V ⎓ • Maximum switching capacity on resistive load: 5 A for 250 V ∿ or 30 V ⎓ • Maximum switching current on inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A for 250 V ∿ or 30 V ⎓
R2A R2C	N/O contact of programmable relay R2	

+10	+ 10 V ⎓ power supply for reference potentiometer 1 to 10 kΩ	• + 10 V ⎓ (10.5 V ± 0.5V) • 10 mA max.
AI1+ AI1 -	Differential analog input AI1	• -10 to +10 V ⎓ (max. safe voltage 24 V)
COM	Analog I/O common	0V
AI2	Depending on software configuration: Analog voltage or current input	• Analog input 0 to +10 V ⎓ (max. safe voltage 24 V), impedance 30 kΩ or • Analog input X - Y mA, X and Y can be programmed from 0 to 20 mA Impedance 250 Ω
AO1	Depending on software configuration: Analog voltage or current output	• Analog output 0 to +10 V ⎓, min. load impedance 470 Ω or • Analog output X - Y mA, X and Y can be programmed from 0 to 20 mA Max. load impedance 500 Ω
P24	Input for external +24V⎓ control power supply	• +24 V ⎓ (min. 19 V, max. 30 V) • Power 30 Watts
0V	Logic input common and 0V of P24 power supply	0V
LI1 to LI5	Programmable logic inputs	• +24 V ⎓ (max. 30 V) • Impedance 3.5 kΩ
LI6	Depending on the position of the SW2 switch: LI or PTC	SW2 = LI: • Same characteristics as logic inputs LI1 to LI5 SW2 = PTC: • Trip threshold 3 kΩ, reset threshold 1.8 kΩ • Short-circuit detection threshold < 50 Ω
+24	Power supply	SW1 switch in Source or Int Sink position: • Internal +24 V ⎓ power supply • 200 mA max. SW1 switch in Ext Sink position: • Input for external +24 V ⎓ power supply for the logic inputs
PWR	Power Removal safety function input	• 24 V ⎓ (max. 30 V) • Impedance 1.5 kΩ

Lexium 17 Drive Control **MHDA1008N00** **SER39B4L3SR**		
Lexium 17 Drive Control **Circuit diagram, functions**		

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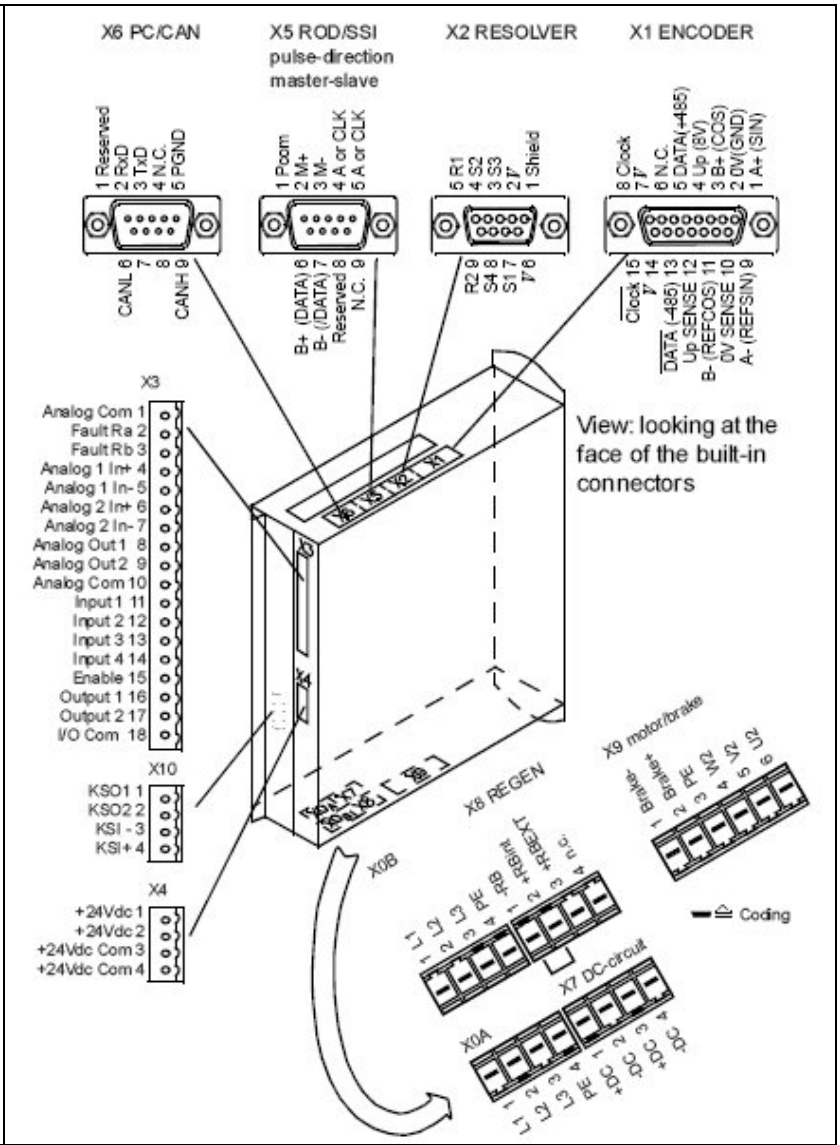
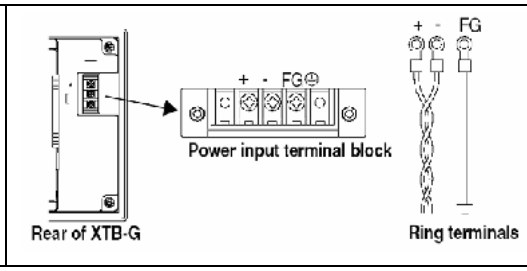
Lexium 17 Drive Control **Terminal description**	
Lexium 17 Drive Control **AM0SER001V00 Sercos card**	
Magelis Panel Display Terminal **XBT-G 2330 5.7" display**	 

Software

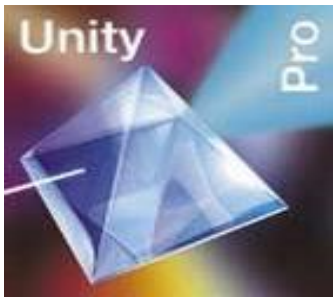
General

You will need to install the Unity Pro programming software for the Premium PLC and the UniLink software for configuring the servo motors. You will also need the Vijeo Designer software for configuring the HMI and creating the necessary diagrams. The PowerSuite software can be installed in order to maximize user-friendliness in respect of parameterization, archiving and simulation for the variable speed drive (ATV31). However, this is currently only supported by ATV31 drives (and not ATV71).

The following installation requirements apply in respect of all software packages:

- Operating system: Windows 2000 (SP1 minimum) or Windows XP
- Free hard disk memory: At least 2.4 GB, 4.4 GB recommended
- User memory: At least 512 MB, 1024 MB recommended
- Processor: Pentium III or higher with min. 800 MHz, 1.2 GHz recommended
- Interfaces: Serial interfaces as a minimum, USB recommended in addition
- Additional software: Internet Explorer 5.5 or higher

Software



Communication

General

- The Sercos bus is used for communication between the servo drive controllers (Lexium17) and the PLC. For this purpose a Sercos ring must be set up from the PLC to the individual controllers and back to the PLC. The servos and the PLC card are connected directly via fiber optic cables.
- The connection between the PLC and HMI (Magelis graphic panel) is made via a serial connection cable (XBTZ968) and the devices communicate using the Unitelway protocol.
- An Ethernet port, which can be used to exchange data with other systems (other PLCs, data acquisition systems, etc.), is also available as an option on the PLC. This port can also be used as a programming interface.

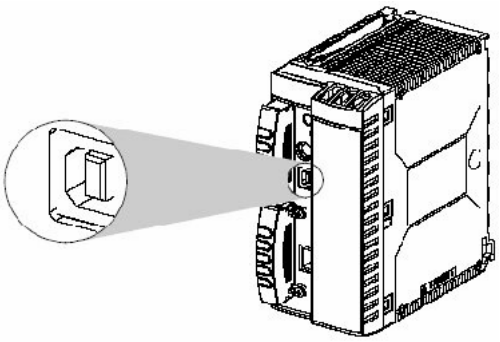
Premium PLC TSX P57 3634

HMI

The HMI is connected directly via the cable (**XBTZ968**) at the **AUX** port.

Programming

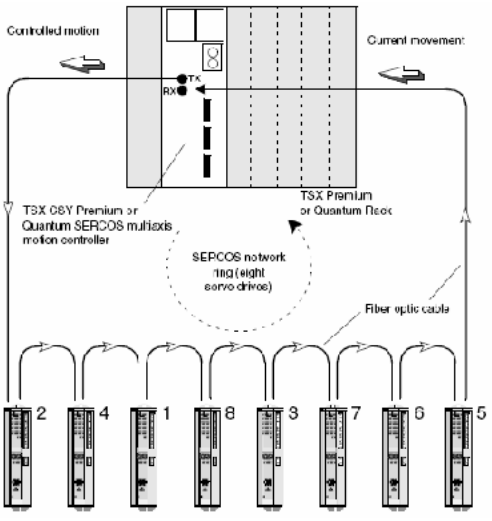
For the purpose of programming, cable TSX PCX 1031 (switch position "0") is used to establish a connection between the serial interfaces on the PC and PLC. Alternatively, an Ethernet link can be used, once the Ethernet port has been configured.



Sercos

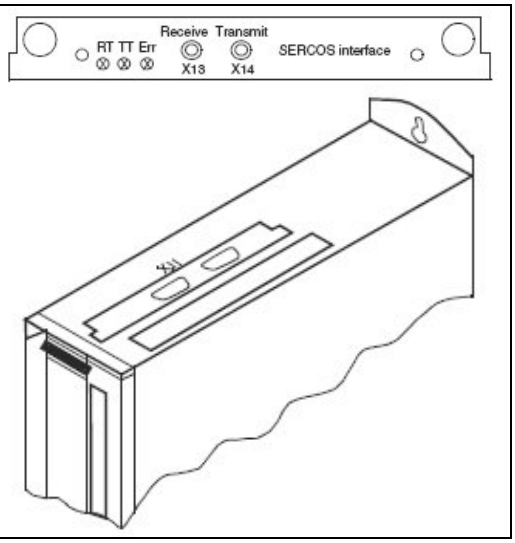
The Sercos interface card TSX CSY 84 is installed in two slots on the rack. The lower slot number must be an odd number.

The Sercos ring starts from the **TX Send** port and connects the servos in series. After the last servo, the ring is closed by connecting to the **RX Receive** port.



Lexium17

The Sercos plug-in card is installed in slot X11 in the drive controller. The bus is wired to the PLC using fiber optic cables (see above).



Magelis XBT-G2200

The connection to the PLC is made via the cable (XBTZ968). A 25-pin sub D connector is provided for this purpose on the HMI.

Implementation

Introduction

The implementation chapter describes all the steps necessary to initialise, to configure, to program and start-up the system to achieve the application functions as listed below.

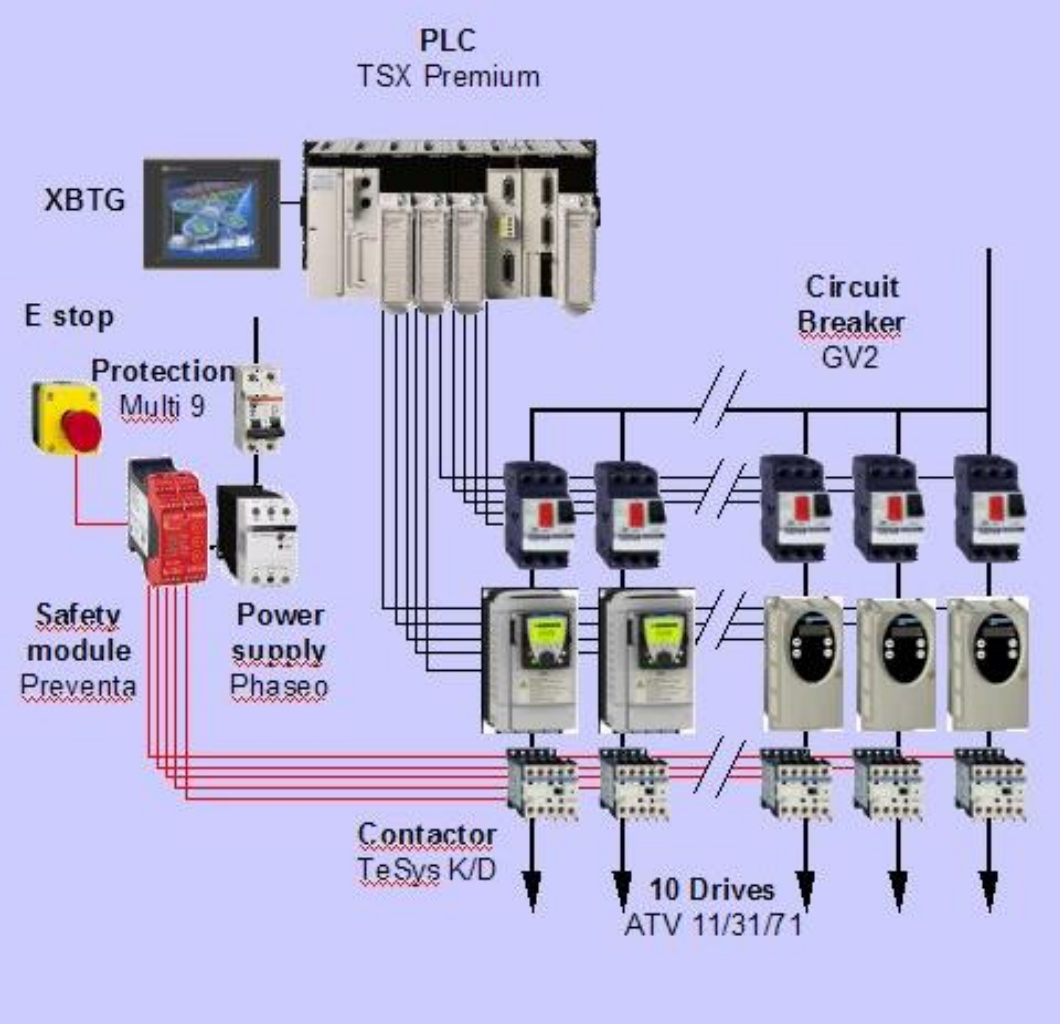
Function

1. With the exception of the safety functions, the entire application is controlled via the PLC. For this purpose, in the PLC, the input signals, the information from the drives and the inputs are analyzed via the HMI and the drives are controlled and the outputs set on the basis of these data.
2. Independently of the PLC, the application features two Category 4 safety circuits for the emergency-off and door-safety functions. When tripped, these disconnect the power supply to the drives and PLC outputs and inform the PLC accordingly.
3. The variable speed drives are controlled via I/O signals; to this end the signals for forward and reverse travel are sent to the digital inputs on the variable speed drives. The required speed is sent as an analog value. A fault signal and arrival at the setpoint are signaled to the PLC via the outputs. The remaining free inputs on the drives are available for extended functions.
4. In the case of the servo drives, travel information is exchanged via the Sercos bus. This generally involves sending direct positioning data and the velocity to the variable speed drives; special commands and parameters can also be sent, however.
5. The application can run in automatic mode, which is controlled via a sequencer and features one sequence for a variety of drive functions. Regardless of the sequencer, two drives are also configured for continuous operation.
6. As well as displaying up-to-date information about the application, the HMI provides access to application control functions. This usually involves switching between manual and automatic mode. The drives can be controlled individually in manual mode.

The PLC program, therefore, represents a framework for a typical application but without simulating any of the actual functions of a specific machine.

Note: Both the ATV31 and the ATV71 can receive their control data from a choice of two sources. For example, both device types can be set so that they are controlled either via I/O signals or via a fieldbus (CANopen). Fieldbus mode usually requires a state machine to be programmed, however.

Functional Layout



Procedure

Proceed as follows to optimize the setup time of the individual products:

1. Parameterize the ATV31 and ATV71 variable speed drives (motor parameters, control profile, I/O assignment).
2. Parameterize the Lexium17 servo drives using the UniLink software (Sercos parameters, basic settings, controller optimization, operating modes).
3. Program the PLC (basic configuration, communication, variables, blocks for drives, manual mode, automatic mode).
4. Configure and program the HMI (data areas, communication, data display, operator controls).

Proceeding in the sequence described above will ensure that the relevant information can either be imported directly or entered manually from the previous action.

HMI

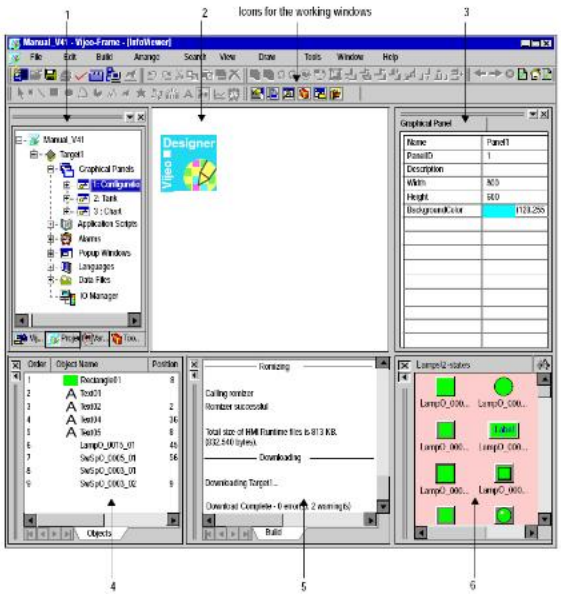
Introduction

In this application, a Magelis XBT-G 2330 HMI connected to the PLC via the Unitelway protocol is used. Vijeo Designer software is used to configure and program the terminal. The steps to be taken in order to create and upload a program are described on the following pages.

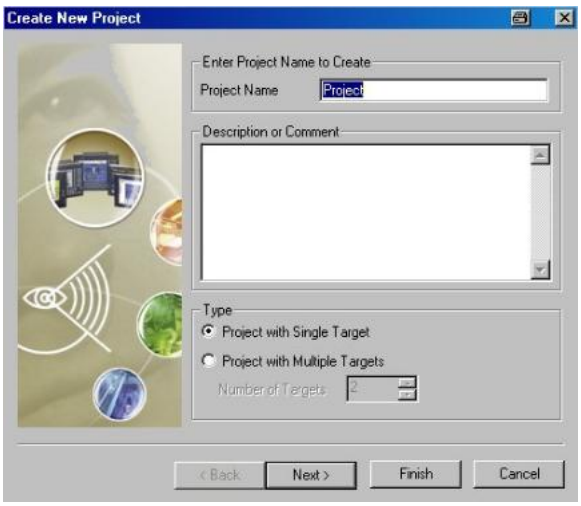
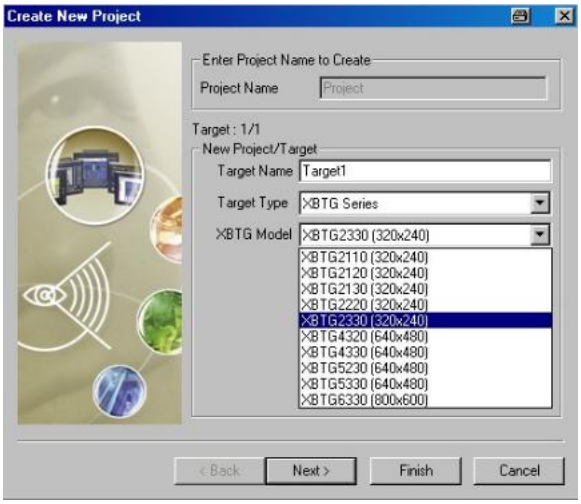
Proceed as follows to integrate the HMI:

1. Vijeo Designer function overview
2. Create new project (specify platform, hardware, communication).
3. Communication settings
4. Set up new variables
5. Set up animations
6. Check the project and download it
7. Overview of example project

Function Overview

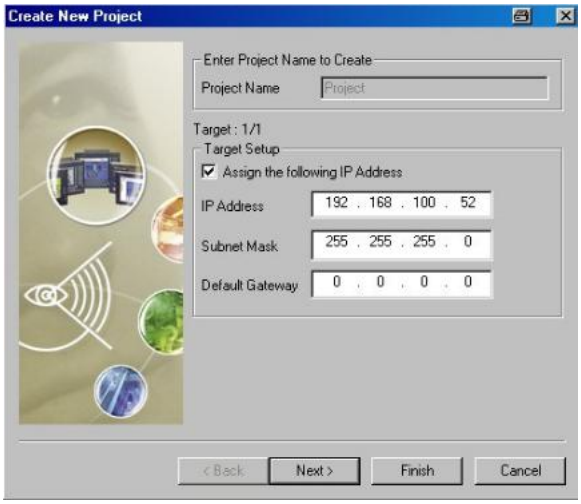
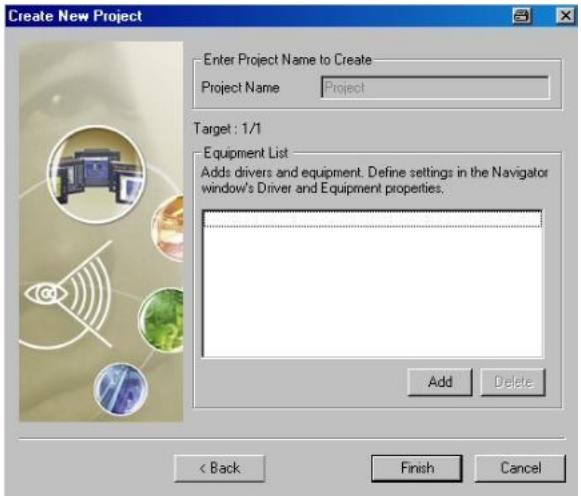
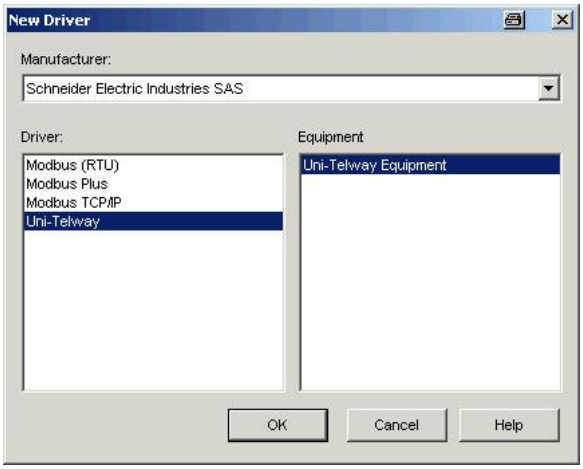
1	The Vijeo Designer environment consists of the following elements: 1 Navigator 2 Information display 3 Inspector 4 Data list 5 Feedback area 6 Toolbox	

Create a New Project

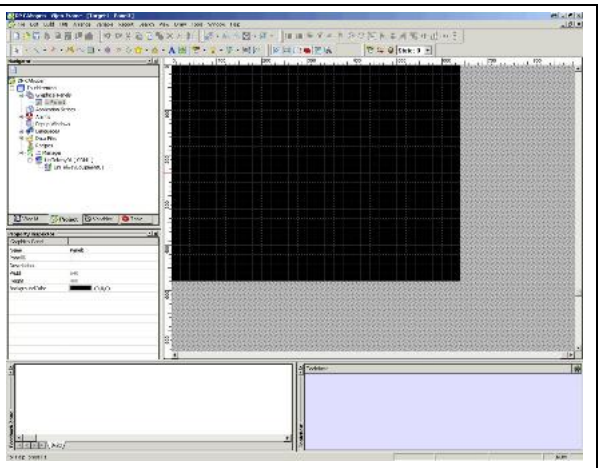
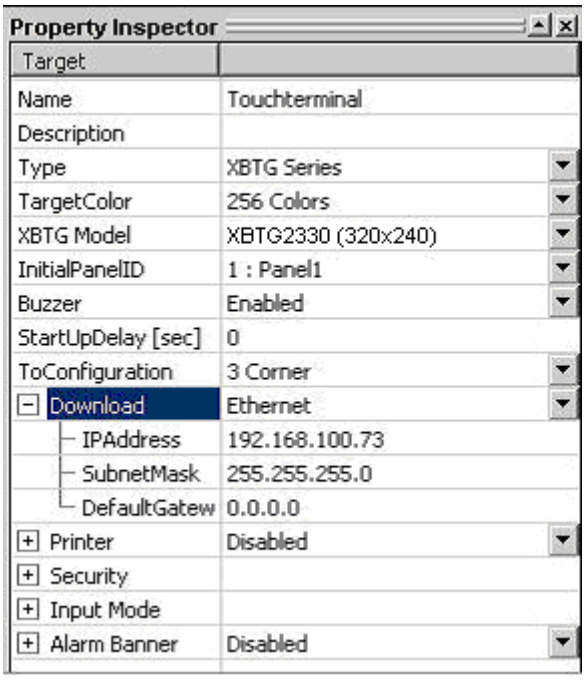
1	When Vijeo Designer starts up, a selection window appears. Select **Create new Project**. You will be automatically guided through subsequent steps.	
2	Enter a project name for the application and a comment (if required).	
3	Next select the target device used and enter a logical name. Example project: • Target name: “Platform1” • Target type: **XBTG Series** • XBT-G Model: **XBT-G2330**	

Continued on next page

Create a New Project, Contd.

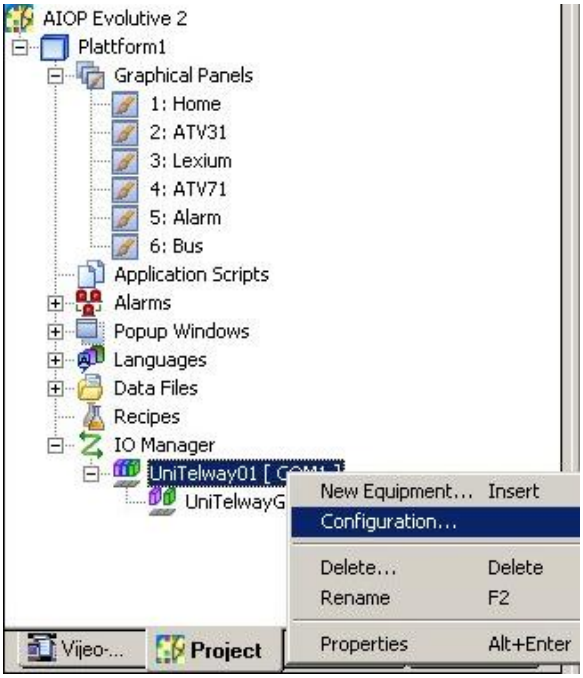
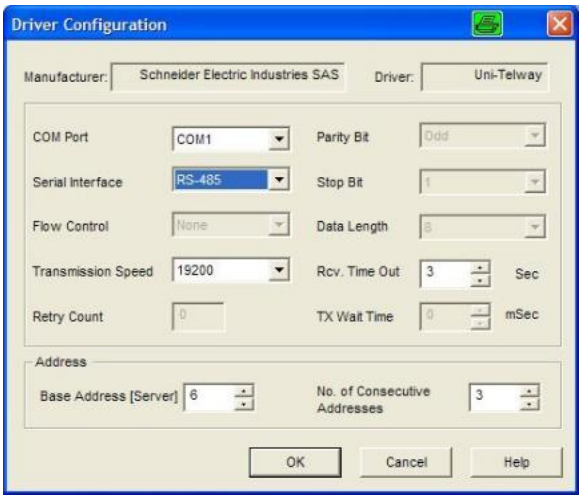
4	In order to use the device's Ethernet interface, you need to enter the IP address, subnet mask and, if applicable, the gateway.	
5	In order to be able to exchange data with the control system, the Magelis terminal requires a communication driver. To select a driver click on the **Add** button.	
6	For communication with the PLC select: **Schneider Electric Industries SAS** from the **Manufacturer** list. Select **Uni-Telway** as driver and **Uni-Telway Equipment** under **Equipment.** Once you have selected a communication driver, you can complete the creation of the new project by clicking the **OK** button.	

Communi-cation Settings

1	Once you have created the project, VijeoDesigner displays the workspace described above with an empty edit screen on the right-hand side.	
2	To download the project you must change the settings to Ethernet. To do this, right-click with the mouse on the target in the **Navigator** and select **Download** in the **Property Inspector**. In order that the project can be transferred to the Magelis HMI, you must select **Ethernet** as well as the IP address and the subnet mask.	

Continued on next page

Communi-cation Settings, Contd.

3	The interface parameters must be declared to the Unitelway driver for communication with the PLC. Right-click with the mouse on **Unitelway01** and select **Configuration…**.	
4	The interface parameters required for successful configuration are: • COM1 • RS-485 • 19,200 baud • 8 data bits The configuration must match up to the PLC port.	

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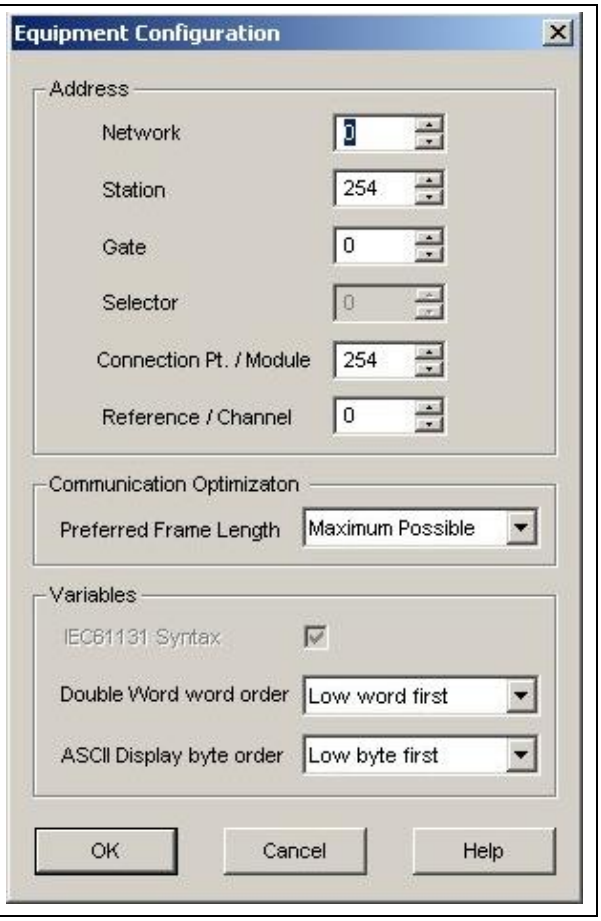
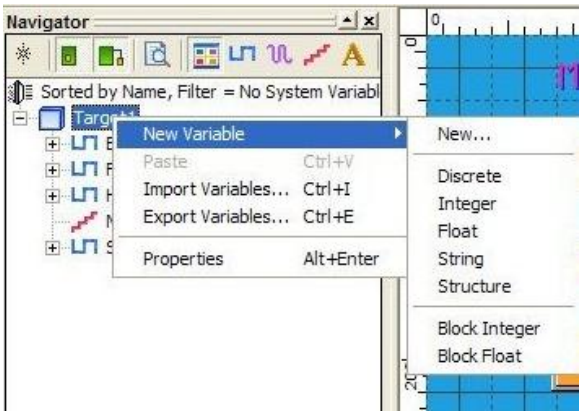
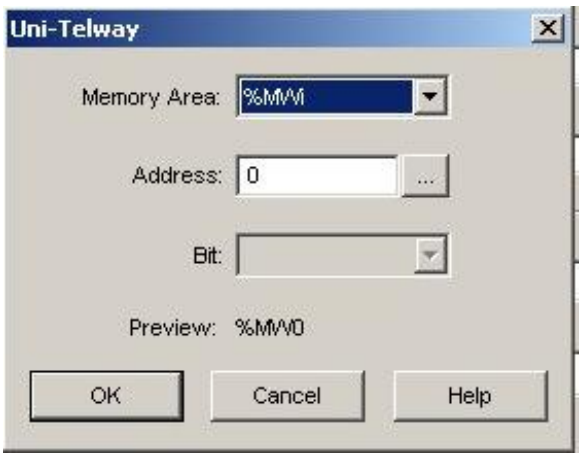
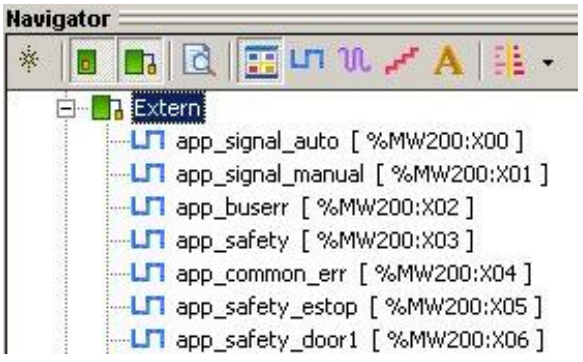
Communi-cation Settings Contd.

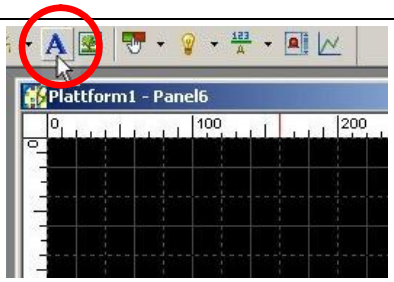
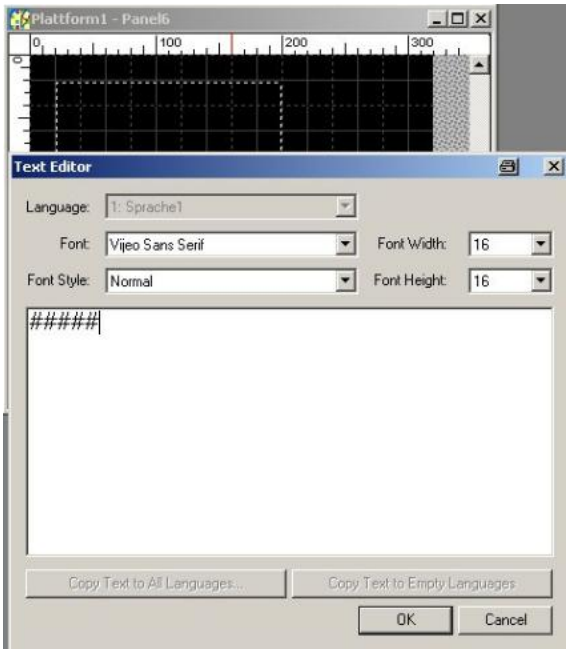
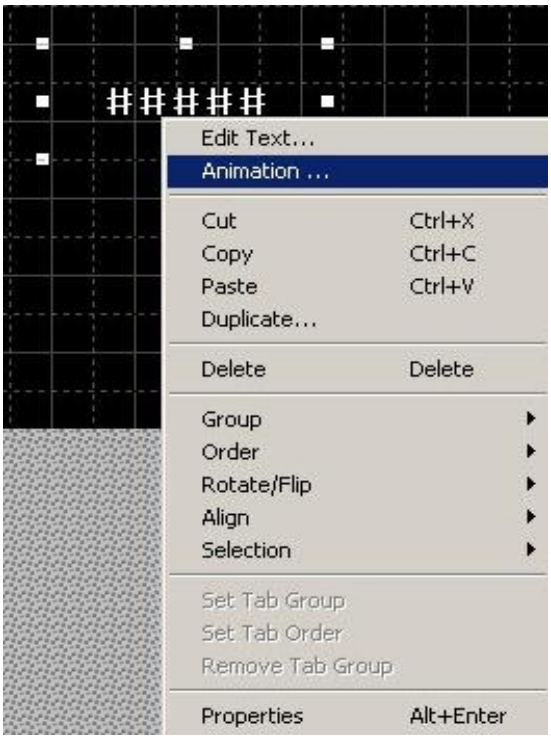
5	Finally, call up the configuration for the device set under **Unitelway01** in the **Navigator** (**UnitelwayDevice01**) and check the settings. The default settings can usually be used, although you may need to modify the address if there are several devices on the Unitelway network.	

Creating Variables

1	To create new variables in the **Navigator**, select the **Variable** tab at the bottom of the navigator. Right-click with the mouse on the target platform (Platform1 here) to access a popup menu and select **New Variable->New**....	
2	To create variables, the following information must be entered: • Variable Name • Data Type • Data Source (External) • Address in the PLC	
3	All memory types on the PLC can be addressed (in addition to flags (%M), words (%MW), double words (%MD), and floating points (%MF), also system bits (%S) and words (%SW), and constant bits and words (%K, %KW)). All data to be displayed on the Viewer must be transferred to one of these types.	
4	The variables created are displayed in the Navigator, along with their names and addresses. In the example project, all variables (even Boolean variables) are assigned to flag words (the "Visu" section in the PLC program is associated with this).	

Creating Images

The process for creating animations on screens will now be described using an example text. The functions are similar for other animation elements.

1	**Example: Enter text** Selection from the menu bar. Various icons and elements are available in the menu bar and the toolbox.	
2	**Example: Edit text** The following information is defined: • Font size • Text content • Font style • etc.	
3	**Example: Animate text** Start by selecting the text element and calling up the dialog box by right-clicking with the mouse. Next select the "Animation" function. You can also do this via the Properties screen (described above).	

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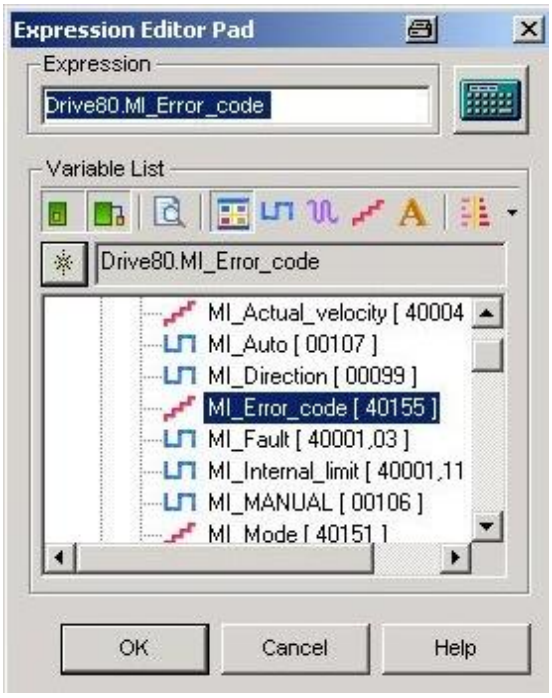
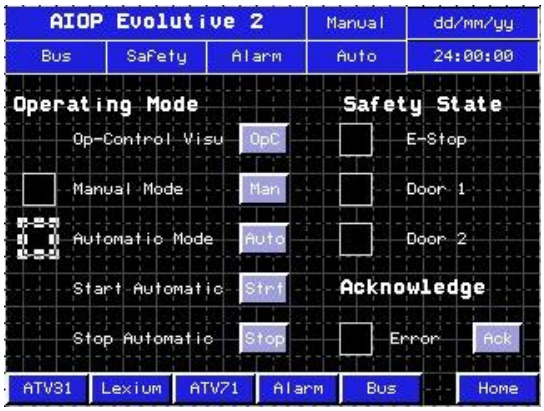
4	**Animation properties:** • Color • Position • Value • Visible After activation you can select a variable for the value animation and the display format.	
5	The variable to be animated can be entered directly in the line or looked up by selecting the (icon) at the end of the line (light bulb). A variable name that has been entered but not recognized appears in red. Additional functions, e.g., value inversion, can be executed by clicking on the calculator icon.	
6	The display opposite shows the completed startup screen in which the separate properties for animation and actions appear.	

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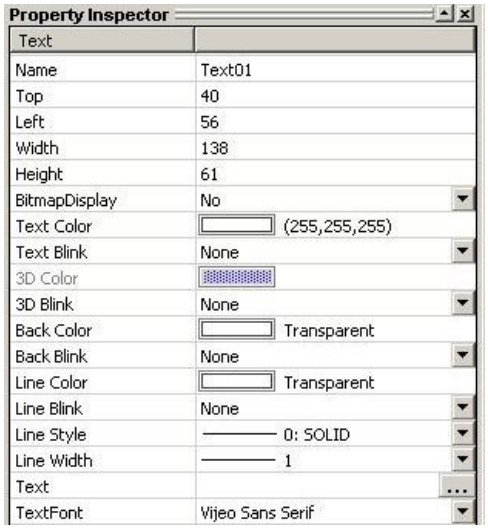
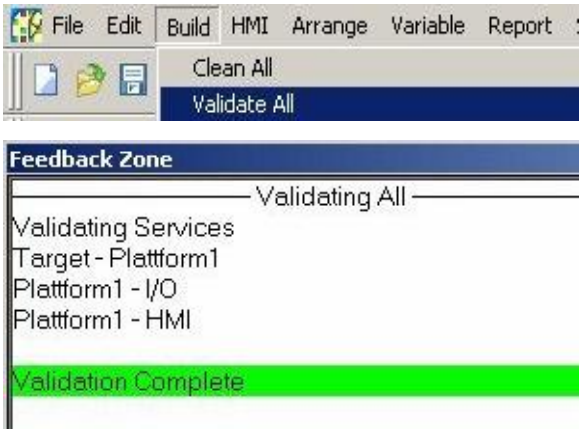
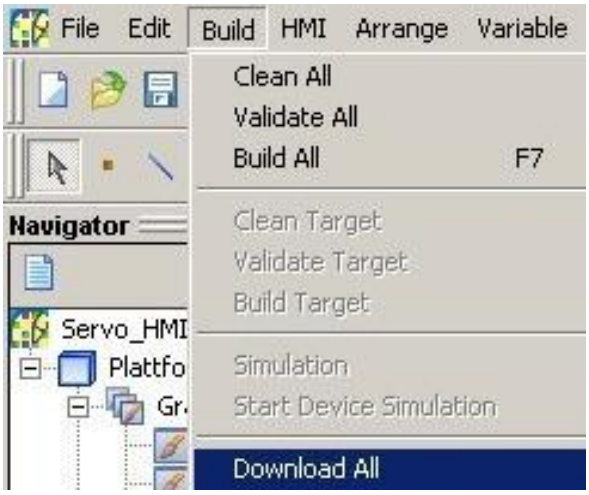
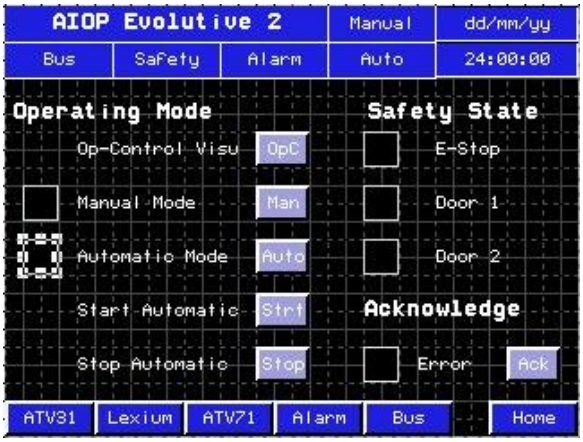
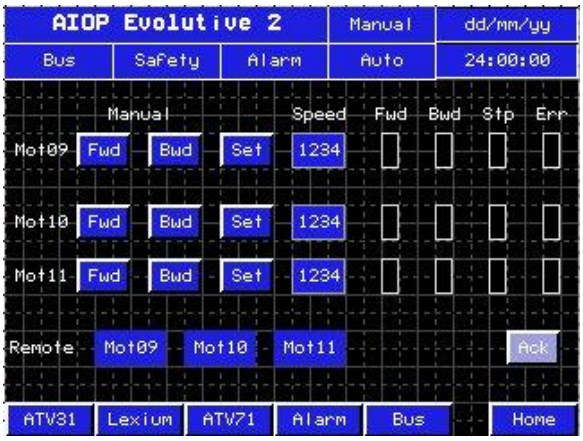
7	**Property Inspector** Each animation element on the screen has its own **Property Inspector** (right-click on the object in the panel with the mouse) with which all settings associated with the object can be viewed and modified.	

Project Download

1	Before being downloaded to the Touch Panel, the project must first be analyzed. To do this, select: **Build->Validate All** The results are listed in the **Feedback Zone**.	
2	Select: **Build->Download All** to transfer the application to the connected Magelis terminal. The connection selected at the outset (Ethernet) is used.	

Application Overview

1	The example application features a number of displays that can be selected by the user. The display opposite shows the main screen from where all other displays can be accessed. The application overview, providing access to error messages and safety indicators, as well as to the selection of the operating mode, also appears here. In principle, all screens are structured in the same way and all essential system status data appear in the header. You can switch from one screen to another by clicking the buttons in the footer.	
2	All drives can run in manual mode and be controlled directly via the Viewer. To do this, you must first switch to the relevant screen. There is one button for forward travel and another for reverse travel. For the ATV71, you can also specify a velocity and set ramps by clicking on **Set** . The status message and speed display act as feedback.	

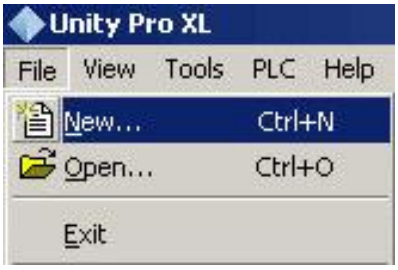
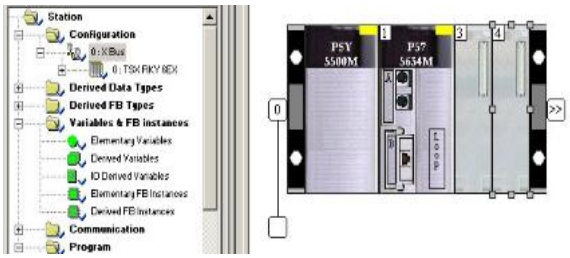
PLC

Introduction

This chapter describes how to create a PLC program, including the logic for the example application, using the Unity Pro software. Proceed as follows to integrate the PLC:

1. Create new project and select hardware.
2. Configure the inputs and outputs.
3. Configure Sercos communication.
4. Configure Ethernet communication.
5. Create application program (logic) (drives, manual mode, automatic mode).
6. Create visualization interface.
7. Connect to PLC and download program.

Creating a New Project

1	After starting Unity, the first thing you need to do is create a new project.	
2	To do this you must first select the correct PLC.	
3	Select **Configuration** in the project browser to open the hardware configuration. Modify the number and size of the racks accordingly (example project: 2 racks with 12 TSX RKY 12EX slots).	

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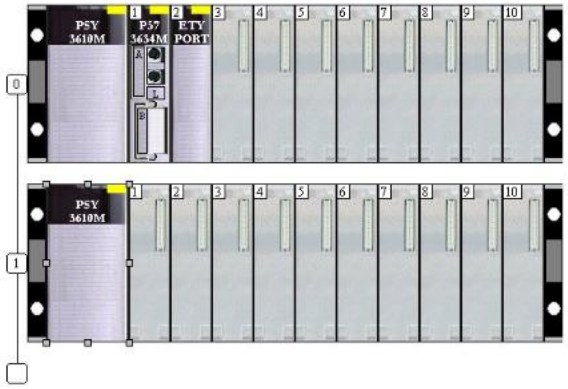
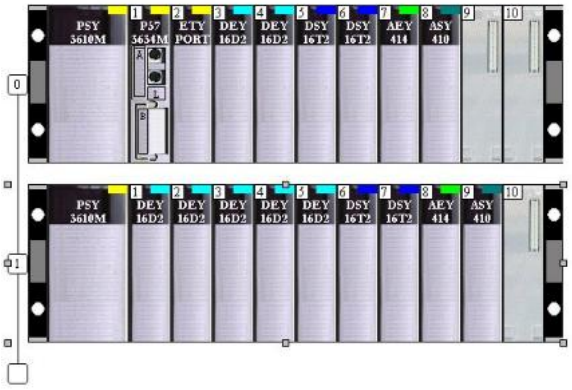
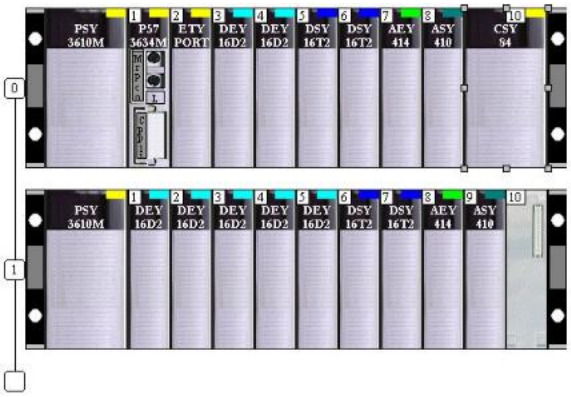
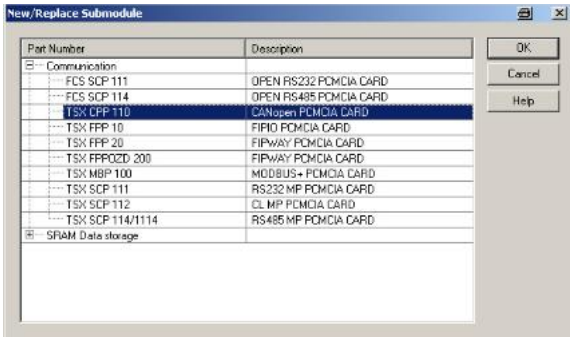
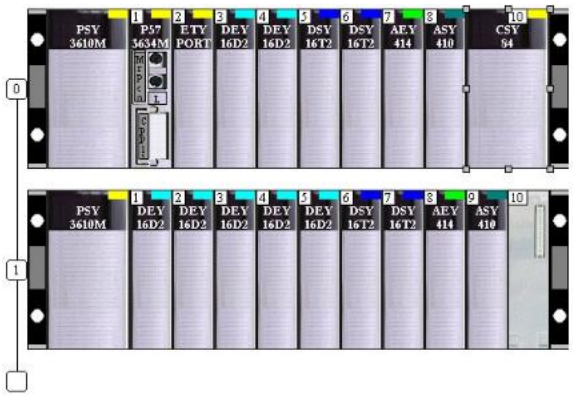
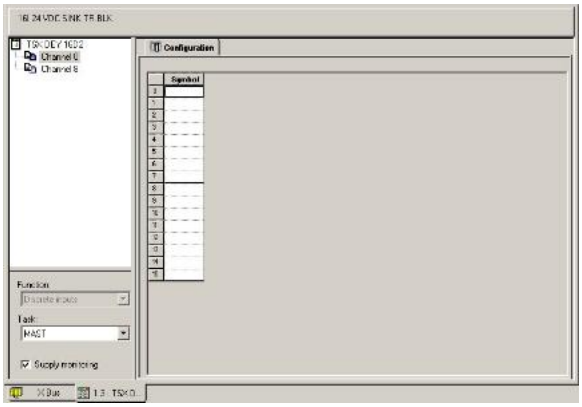
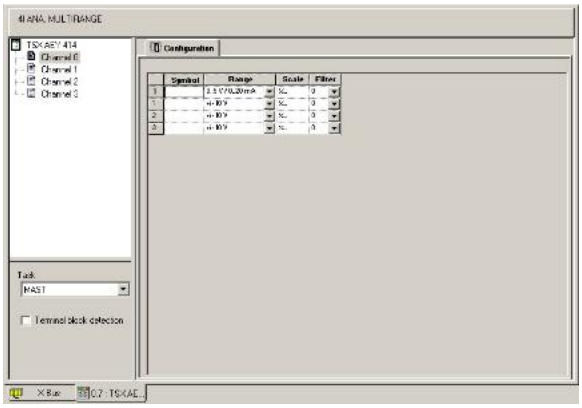
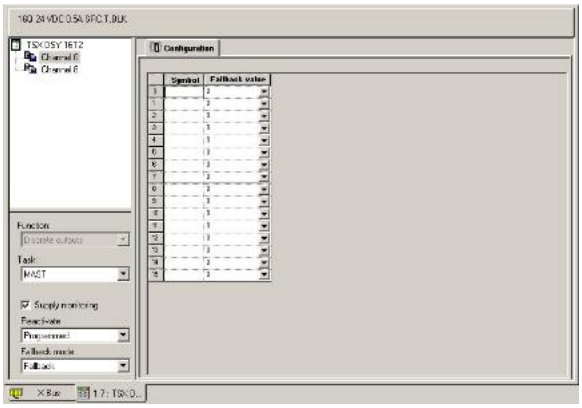
4	If you are using a double-width power supply, you must drag&drop the CPU to position 1 in order for the correct power supply to be inserted. (example project: **TSX PSU 3610**).	
5	Drag&drop is also used to move the individual modules to the right slots example project: 112 digital inputs 64 digital outputs 8 analog inputs 8 analog outputs 7x TSX DEY16D2 4x TSX DSY 16T2 2x TSX AEY 414 2x TSX ASY 410.	
6	The **TSX CSY 84** card must be selected for the Sercos bus. Although the card must be inserted in a slot with an even number, it will also occupy the previous slot.	
7	Double-click on the CPU's upper PCMCIA slot (A) to open a window listing the permitted PCMCIA cards. Enter memory card TSX MRP C001M (or higher if necessary) for slot A. Now save the project.	

I/O Card Configuration

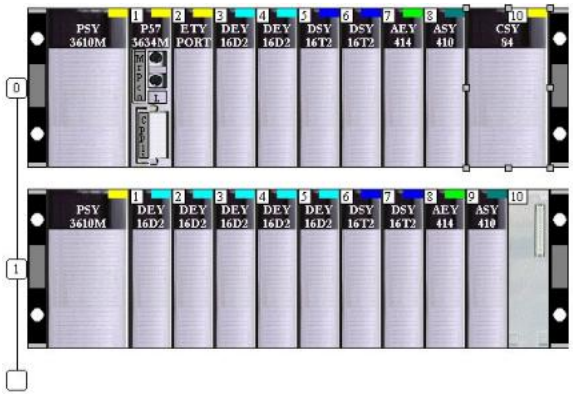
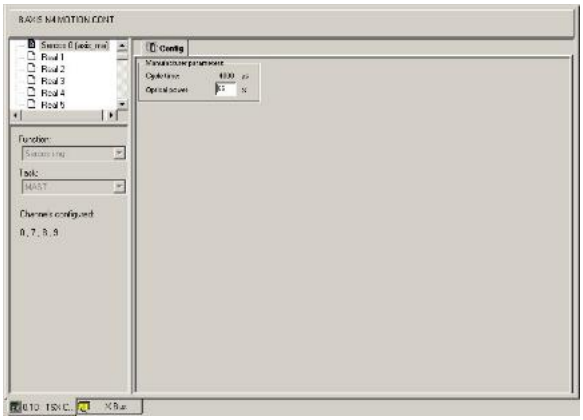
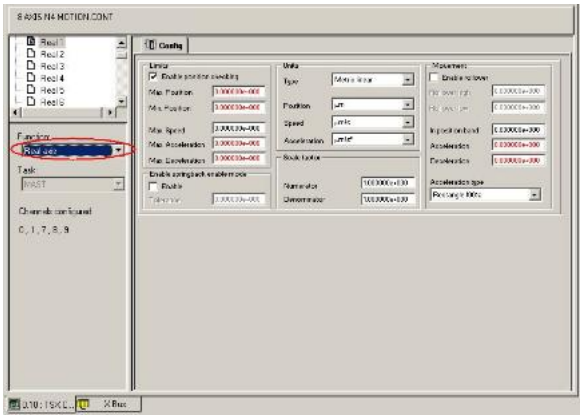
1	Double-click on the relevant module in the hardware view to open the configuration area for input and output cards. Configure each card individually and confirm your settings on completion.	
2	Digital inputs (**TSX DEY 16D2**): Eight inputs are grouped in one channel. Each channel (0 and 8) must be assigned to the task to be performed. The inputs of channel 8 can also be disabled (no function).	
3	Digital outputs (**TSX DSY 16T2**): Eight outputs are grouped in one channel. Each channel (0 and 8) must be assigned to the task to be performed. The behaviour of each channel in the event of a fault and on restarting also needs to be defined. In respect of behavior in the event of a fault, a separate value can be defined for each output. The inputs of channel 8 can also be disabled (no function).	

Continued on next page

I/O Card Configuration
Contd.

4	Analog inputs (**TSX AEY 414**): Each input is considered as an individual channel, which must be assigned to the task to be performed. The type of signal (current, voltage, thermo) and a scale also have to be entered. The inputs can also be smoothed using a filter function.	
5	Analog outputs (**TSX AEY 414**): Each output is an individual channel, which must be assigned to the task to be performed. The type of signal (current, voltage) and a scale also have to be entered. In respect of faults, a value to which the relevant output is set can be entered.	
6	The configuration must then be confirmed or validated. You can do this by either closing the configuration window or selecting Validate from the Edit menu. **Note:** You can only save, close and generate the project after you have validated it.	

Sercos Communi-cation

1	Double-click on the **TSX CSY 84** card to open the Sercos bus configuration.	
2	The Sercos bus addresses appear on the left of the configuration screen as a tree. Various functions are assigned to the addresses. The bus master (**TSX CSY 84**) has address 0, the real axes used in the application are assigned to addresses 1 to 8. The parameters associated with the address selected in the tree appear on the right. No settings need to be made for the master, although the optical power can be modified.	
3	Before you can parameterize an axis, you must enable the function on the left-hand side. Now you can specify the limits for position, velocity and acceleration on the right-hand side. All settings marked in red are obligatory. The following data are used in the project:	
	Limits: max. position: $5*10^5$, min. position: $-5*10^5$, velocity: $1.2*10^4$ Limits: max. acceleration $1.2*10^4$, max. deceleration: $1.2*10^4$ Units: metric linear (mm, mm/min, µm/s^2) Scale factor: numerator: 2, denominator: 1 Motion: destination window: 1.2*104, acceleration: $1.2*10^4$, deceleration: $1.2*10^4$	

Continued on next page

Sercos Communi-cation
Contd.

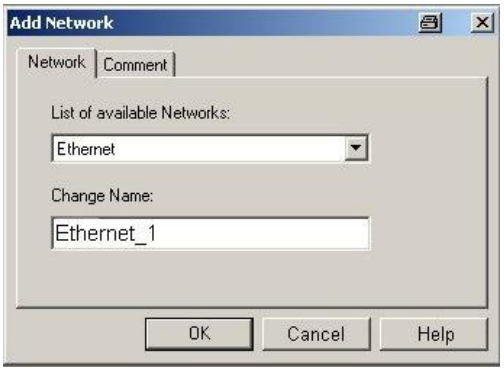
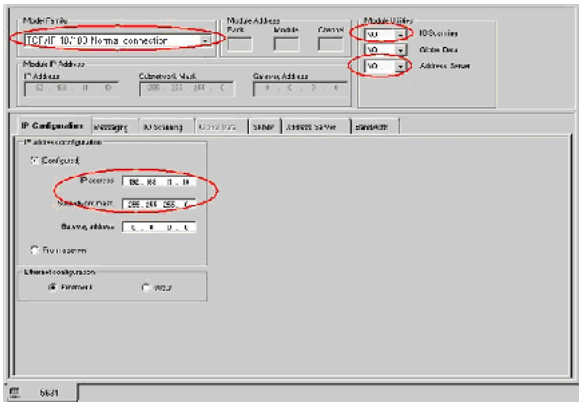
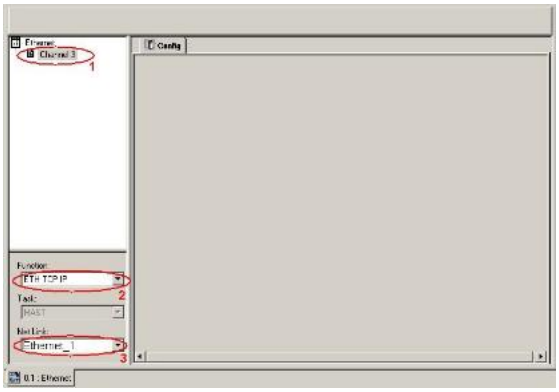
4	The configuration must be repeated for every axis requiring parameterization, and then confirmed or validated. You can do this by either closing the configuration window or selecting Validate from the Edit menu. **Note:** You can only save, close and build the project after you have validated it.	
5	In order to access the axis data, you must create a T_CSY_IND (IODDT)-type variable for each configured axis and assign it to the appropriate channel address. Valid addresses are %CHr.m.c where: r indicates the rack number, m the slot and c the Sercos address. The addresses for the example project are shown opposite. **Note:** A variable can also be created for the master. In this case it must be a T_CSY_RING-type variable.	 With regard to the creation of variables, see also "Creating Variables".

Ethernet Communi-cation

1	Select **New Network...** under **Communication->Networks** in the **project browser**.	

Continued on next page

Ethernet Communi-cation
Contd.

2	In the **Add Network** dialog that now appears, specify **Ethernet** as the network type and enter a name for the network under **Change Name**. Click **OK** to create the network.	
3	Open the network and make the following settings in the sequence described: 1. Select the model family: In the case of TSX P57 3634M, you **MUST** select **TCP/IP 10/100 Normal connection**. 2. Specify the IP address and subnet mask.	
4	The final step consists of assigning the configured network to the hardware. To do this, switch to the hardware view and open the network connection by double-clicking on the CPU network connection. Proceed as follows: 1. Select the channel (in this case: channel 3). 2. Select the function (in this case: ETH TCP IP). 3. Select the network link (the configured connection)	

Address Overview

Various hardware addresses, as well as memory bits and memory words, are used in the PLC example program. To facilitate orientation, an overview of the addresses used appears below in list format.

Type	Address	Comment
Digital inputs	%Ir.m.x	Digital inputs are specified on a hardware basis: r indicates the rack number, m the slot and x the input number. Example: Emergency-off feedback %I0.3.0.
Digital outputs	%Qr.m.x	Digital outputs are specified on a hardware basis: r indicates the rack number, m the slot and x the input number. Example: Indicator lamp for manual mode %Q0.5.1.
Analog inputs	%IWr.m.c	Analog inputs are specified on a hardware basis: r indicates the rack number, m the slot and c the channel number. Example: ATV feedback %IW0.7.0
Analog outputs	%QWr.m.c	Analog outputs are specified on a hardware basis: r indicates the rack number, m the slot and c the channel number. Example: ATV setpoint %QW0.8.0
Sercos axes	%CHr.m.c	Axis data via the Sercos bus are addressed on a hardware basis: r indicates the rack number, m the slot and c the Sercos address. Example: Axis at Sercos address 8 %CH0.10.8
Sercos master	%CHr.m.c	Sercos-master data are addressed on a hardware basis: r indicates the rack number, m the slot and c the Sercos address. Example: Master %CH0.10.0 (type: T_CSY_RING)
Data for Viewer	%MW200 to %MW299	Data for Viewer are written to flag words. Individual bits are written via block BIT_TO_WORD. Example: Motor velocity %MW220
Data from Viewer	%MW300 to %MW399	Data from Viewer are read by flag words. Individual bits are extracted via block WORD_TO_BIT. Example: Motor velocity %MW220

Altivar Addressing

The I/O signals for the variable speed drives are addressed in the PLC to the following addresses. The tables also show what the signals are used for.

PIN	1st ATV31	2nd ATV31	3rd ATV31	4th ATV31	Use
LI1	%Q0.6.0	%Q0.6.4	%Q0.6.8	%Q0.6.12	Forward
LI2	%Q0.6.1	%Q0.6.5	%Q0.6.9	%Q0.6.13	Reverse
LI3	%Q0.6.2	%Q0.6.6	%Q0.6.10	%Q0.6.14	
LI4	%Q0.6.3	%Q0.6.7	%Q0.6.11	%Q0.6.15	
LI5	%Q1.7.0	%Q1.7.2	%Q1.7.4	%Q1.7.6	
LI6	%Q1.7.1	%Q1.7.3	%Q1.7.5	%Q1.7.7	
R1A	%I1.2.0	%I1.2.2	%I1.2.4	%I1.2.6	Fault
R2A	%I1.2.1	%I1.2.3	%I1.2.5	%I1.2.7	Speed reached
AI3	%QW0.8.0	%QW0.8.1	%QW0.8.2	%QW0.8.3	Speed set point
AOC	%IW0.7.0	%IW0.7.1	%IW0.7.2	%IW0.7.3	

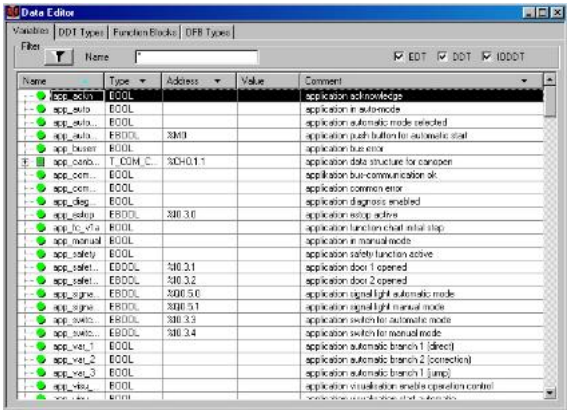
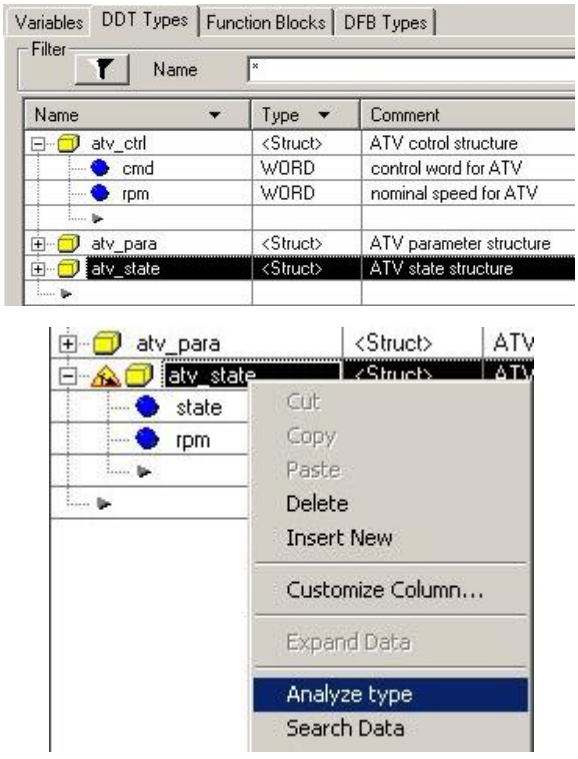
PIN	1st ATV71	2nd ATV71	3rd ATV71		Use
LI1	%Q1.6.0	%Q1.6.4	%Q1.6.8		Forward
LI2	%Q1.6.1	%Q1.6.5	%Q1.6.9		Reverse
LI3	%Q1.6.2	%Q1.6.6	%Q1.6.10		Fast stop
LI4	%Q1.6.3	%Q1.6.7	%Q1.6.11		Ramp switchover
LI5	%Q1.7.8	%Q1.7.10	%Q1.7.12		
LI6	%Q1.7.9	%Q1.7.11	%Q1.7.13		Source switchover
R1A	%I1.2.0	%I1.2.2	%I1.2.4		Fault
R2A	%I1.2.1	%I1.2.3	%I1.2.5		Speed reached
AI2	%QW1.9.0	%QW1.9.1	%QW1.9.2		Speed set point
AO1	%IW1.8.0	%IW1.8.1	%IW1.8.2		

Creating the Application Program

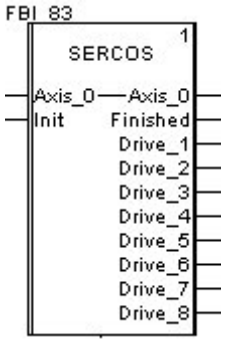
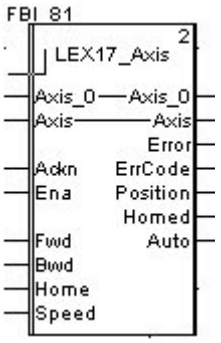
The application program logically simulates the machine and its function. This document and the example application are only able to outline the basic framework for a program of this type. The key steps required to create the application program are outlined below:

1. Creation of variables and I/O assignment
2. Creation of the controls for the servo drives via the Sercos bus
3. Application program and logic creation (motor control, mode control, interfaces for visualization)

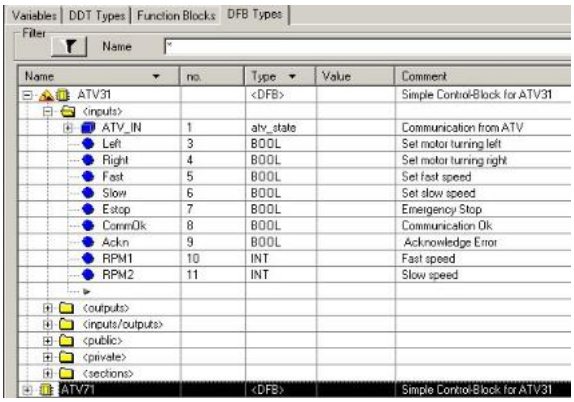
Creating Variables

1	Variables are declared and assigned to inputs and outputs in the Data Editor. The following information is required for a variable: • Name • Type • Address (if applicable) • Init value (if applicable) • Comment Variables are created when they are entered in the Data Editor table.	
2	In the example program, as well as elementary variables for digital and analog data, structures are also used for data exchange with the variable speed drives. These can be created on the **DDT Types** tab in the Data Editor. As well as the name and comment, you need to declare the individual elements of the structure. Right-click with the mouse and select **Analyze type** to complete the definition of the structure. The types can then be used in the context of variable declaration.	

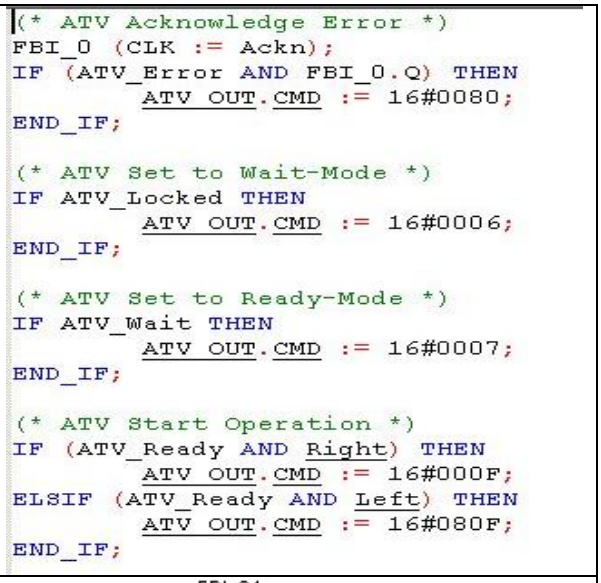
Controlling the Servos

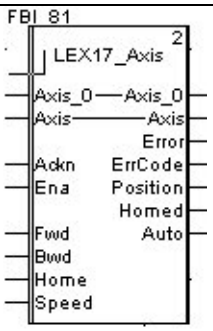
1	In order to control the servo drives via the Sercos bus, you must first initialize the bus and set the enables. In the example program this is done using the "Sercos" DFB.	
2	Once the enables have been set, motion commands can be transmitted to the servos using the WRITE_CMD function. The parameters differ according to the motion command. The example shows an absolute positioning movement.	(* Movement to Belt B *) (*channel 1 absolute movement*) Axis_07.Action_cmd := 513; (* 513: Immediate Movement *) Axis_07.Param_CMD_1 := 0; (* Par1: Movement type: 0 ABS_MOVE *) Axis_07.Param_CMD_2 := 0; (* Par2: not used *) Axis_07.Param_CMD_3 := sc_belt_b[0]; (* Par3: New Position absolute *) Axis_07.Param_CMD_4 := sc_speed; (* Par4: Speed for movement *) WRITE_CMD(Axis_07); (*channel 2 absolute movement*) Axis_08.Action_cmd := 513; (* 513: Immediate Movement *) Axis_08.Param_CMD_1 := 0; (* Par1: Movement type: 0 ABS_MOVE *) Axis_08.Param_CMD_2 := 0; (* Par2: not used *) Axis_08.Param_CMD_3 := sc_belt_b[1]; (* Par3: New Position absolute *) Axis_08.Param_CMD_4 := sc_speed; (* Par4: Speed for movement *) WRITE_CMD(Axis_08);
3	In the example project a distinction is made between automatic and manual mode for the servos. Automatic mode is controlled via a sequencer, in whose action sections motion commands are set using WRITE_CMD. For manual mode a DFB has been written that can be used to enable and move the servo and return it to the home position.	

Creating DFBs

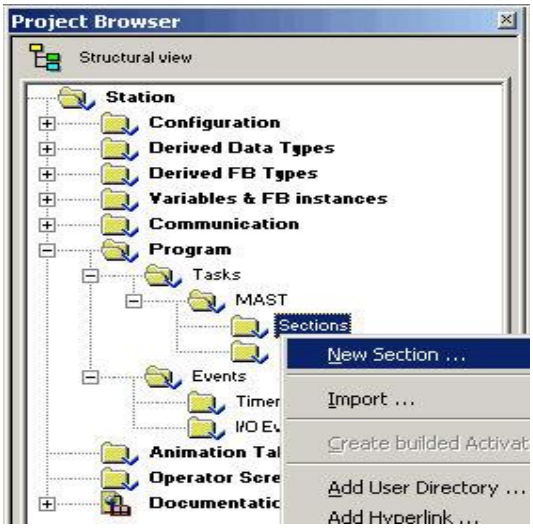
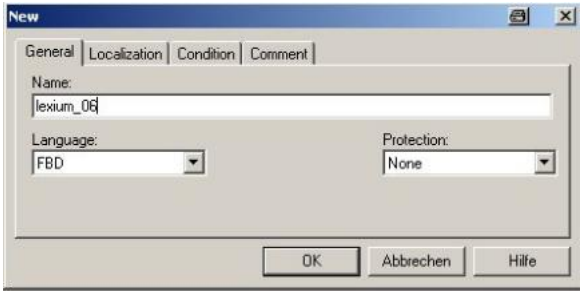
1	The definition of a DFB also starts in the Data Editor (**DFB** tab), where the inputs and outputs, as well as the internal variables of the DFB, have to be defined. The program sections of the DFB can also be created here.	

Continued on next page

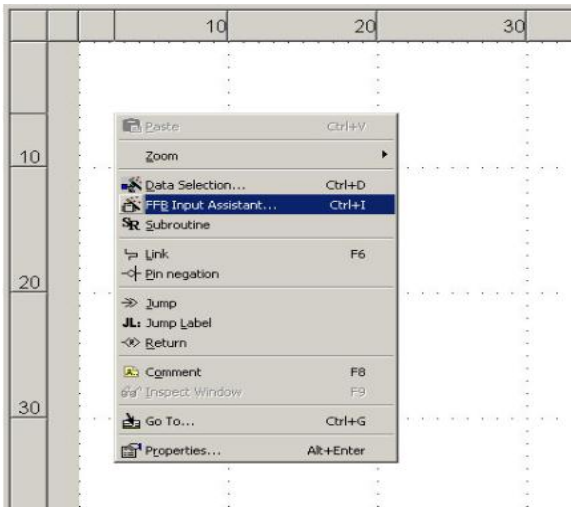
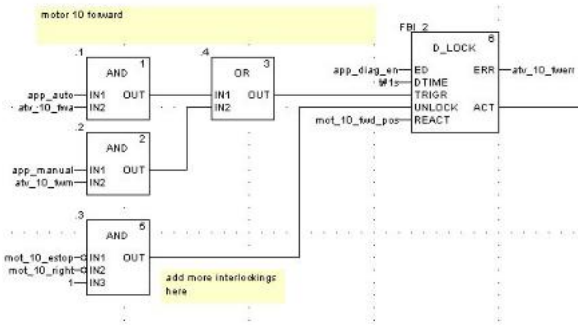
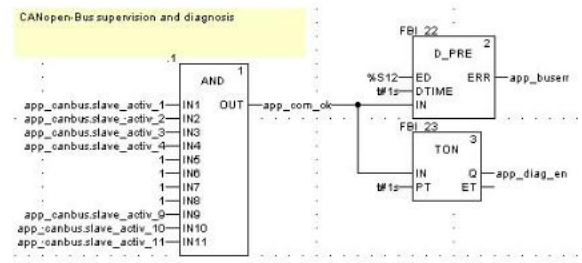
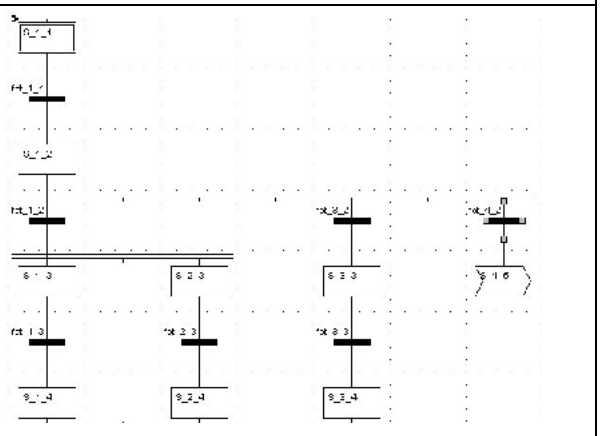
2	The DFB is programmed as structured text in one section in the example program.
	
	Programming is performed in the editor, where code can be entered.
	
	Auxiliary functions for calling individual blocks are also available.
		
		(* ATV Acknowledge Error *)
		FBI_0 (CLK := Ackn);
		IF (ATV_Error AND FBI_0.Q) THEN
		ATV_OUT.CMD := 16#0080;
		END_IF;
		
		(* ATV Set to Wait-Mode *)
		IF ATV_Locked THEN
		ATV_OUT.CMD := 16#0006;
		END_IF;
		
		(* ATV Set to Ready-Mode *)
		IF ATV_Wait THEN
		ATV_OUT.CMD := 16#0007;
		END_IF;
		
		(* ATV Start Operation *)
		IF (ATV_Ready AND Right) THEN
		ATV_OUT.CMD := 16#000F;
		ELSIF (ATV_Ready AND Left) THEN
		ATV_OUT.CMD := 16#080F;
		END_IF;

3	The blocks are called in the section in which instantiation is takes place (the simplest way to call a block is to use the Ctrl+D or Ctrl+I shortcut). Once a block has been called, its name must be entered. The block can then be positioned.	 FBI_81 2 LEX17_Axis Axis_0 — Axis_0 Axis — Axis Error Ackn ErrCode Ena Position Homed Fwd Auto Bwd Home Speed

Creating the Program

1	In the example program, the application logic has been programmed as a function block diagram (FBD). Completed units form a **section**. The **section** must be created first. You do this in the project browser, under **Program**, in the associated task (right-click with the mouse to open the relevant menu).	 Project Browser Structural view Station Configuration Derived Data Types Derived FB Types Variables & FB instances Communication Program Tasks MAST Sections Events Timer Animation Tal Operator Scre Documentatic New Section ... Import ... Create builded Activat Add User Directory ... Add Hyperlink ...
2	Once you have created a new **section** you will need to enter a **name** and programming language for it. In the example programs, with the exception of automatic control, all sections are programmed in **FBD**.	 New General Localization Condition Comment Name: lexium_06 Language: FBD Protection: None OK Abbrechen Hilfe

Creating the Program Contd.

3	The blocks (Ctrl+D) or popup menu (data selection) can then be called up in the section. Other elements such as links, negations or comments can also be accessed in this menu or via shortcuts.	
4	A separate section in which directions can be controlled and parameters defined has been provided in the program for each individual drive. Directions of rotation are controlled separately for each operating mode.	
5	In the "application" section, the operating modes are defined and general monitoring of the safety functions takes place.	
6	A sequencer has been provided for automatic mode to control the machine sequence. Actions and step enables in the next step must be defined for each individual step.	

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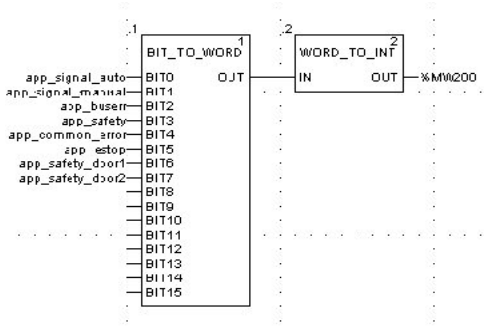
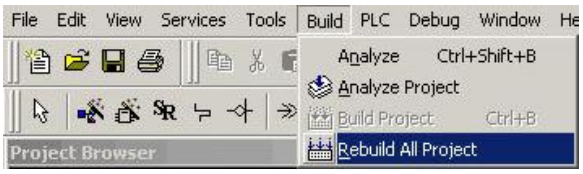
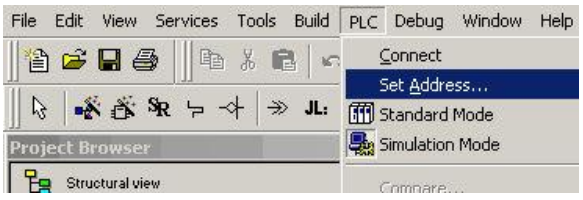
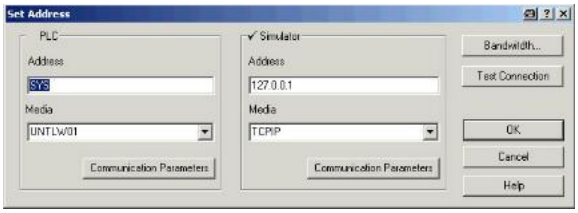
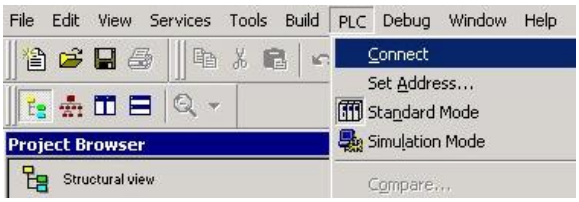
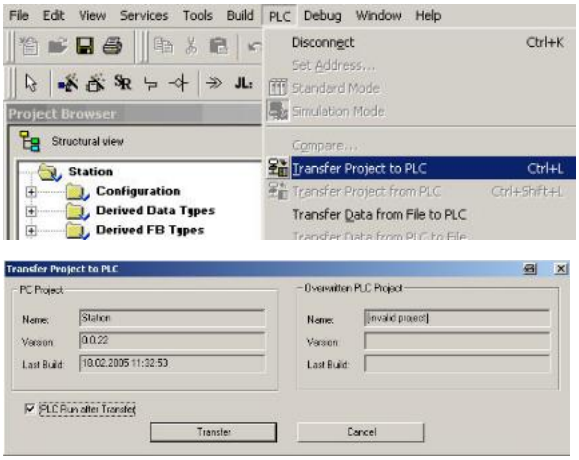
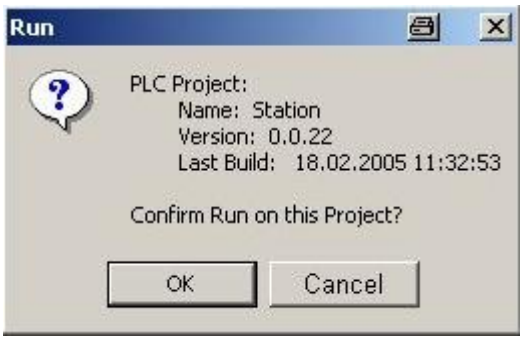
Creating the Program Contd.

7	Data are transferred between the PLC and Viewer in the "visu" section. It is here that the necessary data are written to/read from flag words. The principle that logic functions can only be executed in the PLC applies.	

Program Download

1	Upon completion of programming, the entire project must be rebuilt. To do this, select the relevant menu item or button.	
2	You must define the PLC address before establishing a connection with the PLC. In this case, the UniTelway protocol (UNTLW01) must be selected and the PLC SYS (standard system address) entered as the address.	 
3	The connection is established by selecting **PLC->Connect** Or clicking on the icon in the toolbar. Remember: the appropriate programming cable must be connected to the PLC.	

Program Download Contd.

4	The program can now transfer data to the PLC and the PLC can be started up. **Note:** If you want the PLC to start as soon as the download is complete, you must check the relevant box before starting the transfer	
5	Start the PLC with **OK**.	

ATV31 variable speed drive

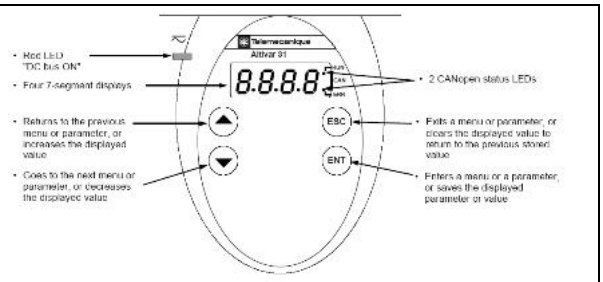
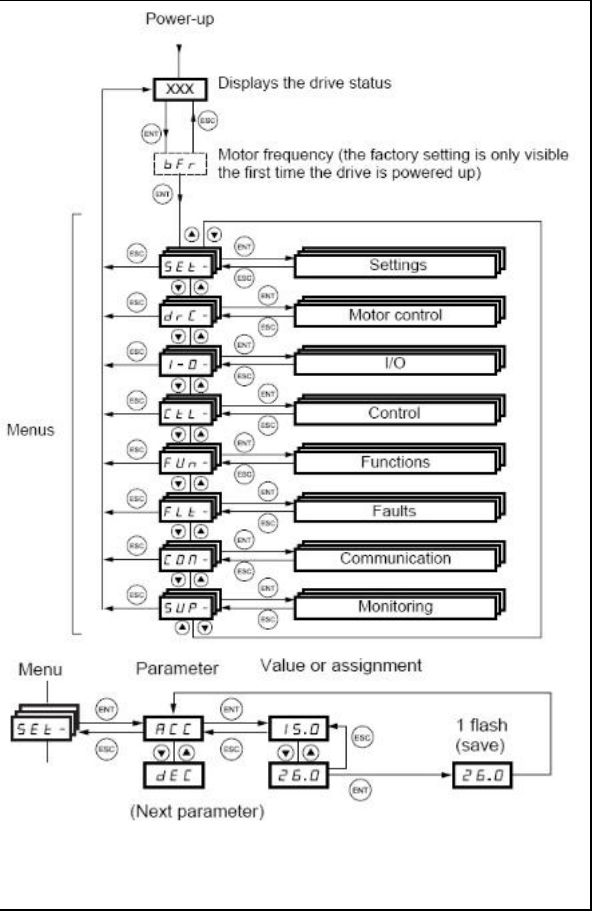
Introduction

The settings for the ATV31 variable speed drive can either be made manually using the control buttons on the device or by means of the PowerSuite configuration software. Subsequently, the configuration only is written via the control buttons, in order to retain consistency between the parameter settings on the ATV31 and those on the ATV71.

In order for the ATV31 to be controlled via I/O signals, the following settings must be made as a minimum:

- Assignment of the control profile and use of the I/O signals
- The line frequency and motor data in accordance with the rating plate

ATV31 Parameters

1	All parameters are set manually using the control buttons on the device.	
2	Use the control buttons to select the "Inputs/Outputs" ("I_O") submenu. The I/O signals are set here: • "tCC" 2- or 3-wire operation • "tct" Edges or signals • "rrS" Signal for reverse 2-wire operation with edges is selected for the variable speed drives in the application. Reverse travel is assigned to input LI2. **Note:** Selecting 2-wire operation automatically assigns forward travel to input LI1.	
3	The source for the speed setting should be specified in the **Control** (Ctl) menu: • "Fr1" Frequency setpoint The analog current input (AI3) is selected for all variable speed drives in the application.	

ATV31 Parameters Contd.

4 Use the control buttons to select the "Motor control" ("drC") submenu. The motor parameters are set here:

- "bFr" Output frequency
- "UnS" Rated motor voltage
- "FrS" Rated motor frequency
- "nCr" Rated motor current
- "nSP" Rated motor speed
- "Cos" Motor power factor

All motor data must be taken from the rating plate.

5 For feedback from the variable speed drive, data can also be assigned to the two digital outputs in the "Inputs/Outputs" ("I_O") menu. The variable speed drive fault message is assigned to the first output by default.

- "r1" Output 1
- "r2" Output 2

In the application, arrival at the setpoint is assigned to the second output. The chart opposite shows the possible functions for the inputs and outputs on the ATV31.

Logic inputs	Code
Not assigned	-
Forward	-
2 preset speeds	PS2
4 preset speeds	PS4
8 preset speeds	PS8
16 preset speeds	PS16
2 preset PI references	Pr2
4 preset PI references	Pr4
+ speed	USP
- speed	dSP
Jog operation	JOG
Ramp switching	rPS
Switching for 2nd current limit	LC2
Fast stop via logic input	FSt
DC injection via logic input	dCI
Freewheel stop via logic input	nSt
Reverse	rrS
External fault	EtF
RESET (fault reset)	rSF
Forced local mode	FLO
Reference switching	rFC
Control channel switching	CCS
Motor switching	CHP
Limiting of forward motion (limit switch)	LAF
Limiting of reverse motion (limit switch)	LAr
Fault inhibit	InH

Analog/logic output	Code
Not assigned	-
Motor current	OCr
Motor frequency	rFr
Motor torque	OLO
Power supplied by the drive	OPr
Drive fault (logic data)	FLt
Drive running (logic data)	rUn
Frequency threshold reached (logic data)	FtA
High speed (HSP) reached (logic data)	FLA
Current threshold reached (logic data)	CtA
Frequency reference reached (logic data)	SrA
Motor thermal threshold reached (logic data)	tSA
Brake sequence (logic data)	bLC

Note

The above parameters represent a minimum configuration in order to be able to run the drive and the motor connected to it safely. Depending on the application, we also recommend modifying regulation via the drive (V/f characteristic) to the application (e.g., pumps or constant torque) by setting the "UFt" parameter accordingly in the "Motor control" menu.

If necessary, other parameters such as those associated with the configuration of the inputs, the setting of the ramps or the use of preset frequencies can also be modified in the same way. If these parameters are also to be modified from the application, they must be addressed accordingly via I/O signals.

ATV71 variable speed drive

Introduction

The ATV71 drive can only be configured via the graphic display terminal on the device. This must also be used for setting up operation via I/O signals.

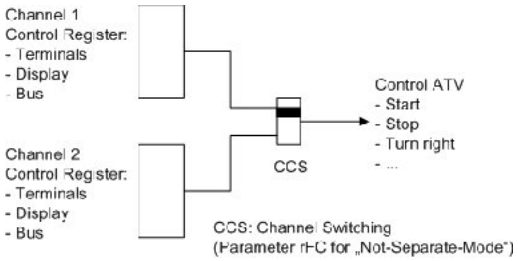
The ATV71 has a number of different operating profiles, which mainly apply to operation with a fieldbus. There are two basic configurations:

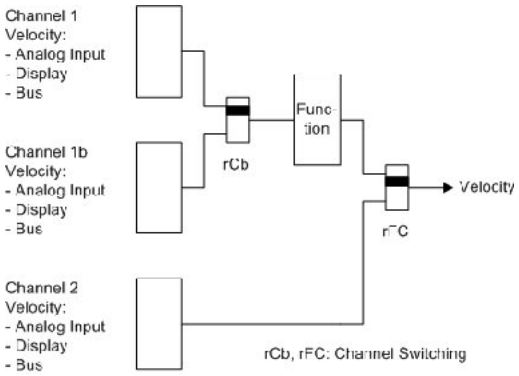
- The ATV71 operates in the DSP402 profile, in other words the DriveCom state machine is absolutely essential for fieldbus operation but is not necessary for operation with I/O signals.
- The ATV71 operates in the IO profile; individual functions, e.g., forward travel, are declared explicitly to the ATV71 (via bus or I/O signal) and the setpoint velocity (reference) is also transmitted via the bus or as an analog signal.

In both cases, it is possible to switch the control signals or setpoint velocity between different sources (bus, I/O signals, display terminal). The following are available:

- Two control registers
- Three velocity references

Switchover can be independent in each configuration, although the DSP402 profile also supports "not separate" switchover (not separate mode).





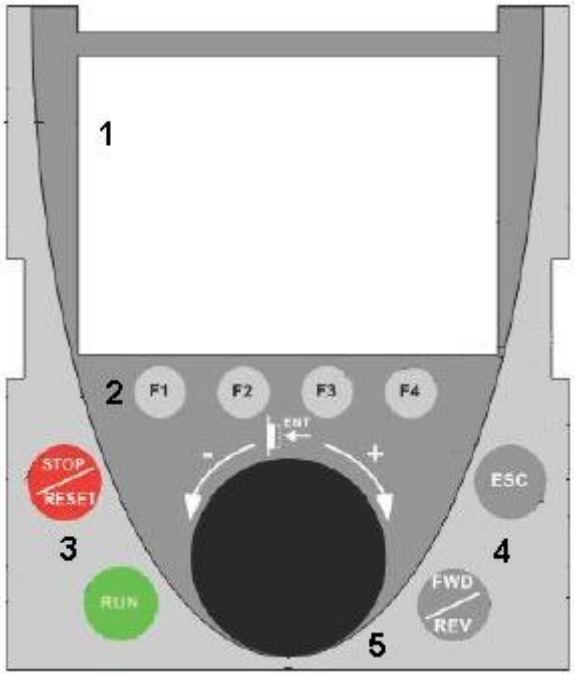
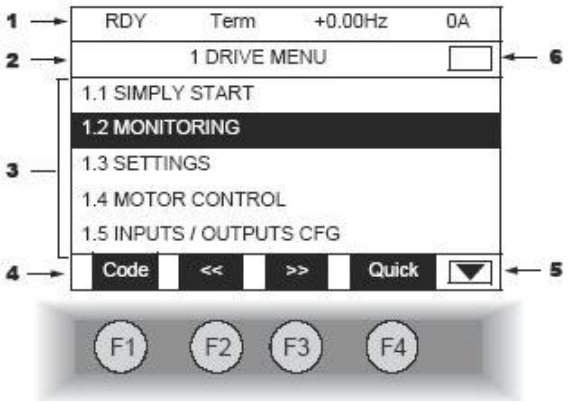
As shown in the figures above, appropriate sources such as terminals or bus can be assigned to the channels for both the control register and the setpoint velocity. Switchover parameters are available, which can be assigned with a switch signal, e.g., a digital input signal.

Taking into account the control options, the following points are relevant in respect of the configuration of the ATV71:

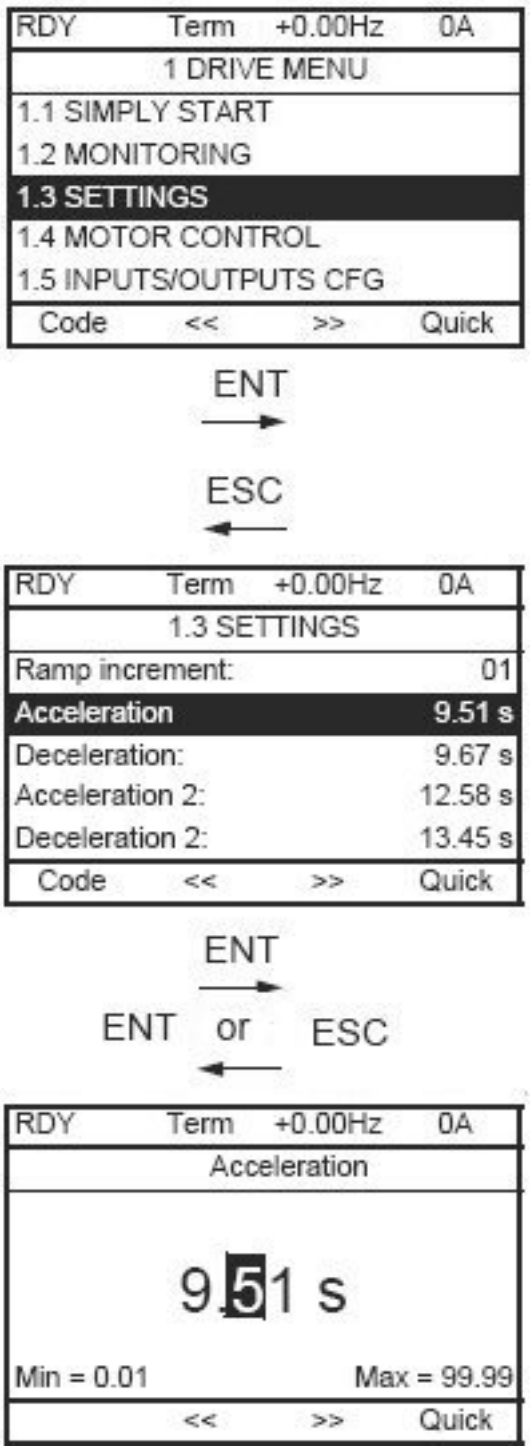
1. Setting of pulse or permanent signals (3- or 2-wire control)
2. Setting of motor parameters in accordance with rating plate
3. Selection of the profile and, if applicable, the switchover type
4. Selection of sources for channels and of switchover signals

In the application only the IO profile is used for the ATV71, since the DSP profile offers no advantages for operation with I/O signals.

ATV71 Parameter Settings

1	All parameters are set manually using the control buttons on the device. 1. Graphic display 2. Function keys 3. Start/Stop button for manual mode 4. Escape key (Esc) to reject a setting Fwd/Rev: Inversion of direction of rotation 5. Navigation key for: • Control in menus • Editing values • Confirming values (Enter)	
2	Description of the display: • Current values of the ATV71 • Name of menu or submenu • Menu elements • Function-key assignment • Scroll down or up (6)	

Continued on next page

3	An example of how values are set via the graphic display terminal appears opposite. 1. Use the navigation key to select the menu, then press the navigation key ("Enter") to confirm your selection. 2. The parameters associated with the menu appear. Use the navigation key to select the value to be changed. 3. Use the navigation key to change the value and then save the value by pressing "Enter" or reject it by pressing "Esc".	

ATV71 Common Settings

The settings common to all speed drives, regardless of the application profile selected, are described here. These include:

- Setting of pulse or permanent signals (3- or 2-wire control)
- Setting of motor parameters in accordance with rating plate

1	The signal-type setting defines whether permanent signals (2-wire) or pulse signals (3-wire) are used for operation.	**[1.5 INPUTS/OUTPUTS CFG]** [2/3 wire control (tCC)]: 2 wire (2C)
2	The data associated with the motor and illustrated on the rating plate have to be set in the "Motor control" menu.	**[1.4 MOTOR CONTROL]** [Output frequency (bFr)]: 50 [Rated motor power (nPr)]: [Rated motor volt. (UnS)]: 400 [Rated drive current (nCr)]: [Rated motor freq. (FrS)]: 50 [Rated motor speed (nSP)]:

ATV71 IO Profile

The settings to be made for a speed drive using the IO profile with switchover of the control register are described here. They represent an example that has also been implemented in the application supplied. The following functions have been implemented for the control system:

- Profile setting with forward/reverse travel and fast stop
- Switchover between two ramps
- Switchover of control register

Unlike the control register, which can be switched over between the ATV display (HMI) and the terminals, the velocity setpoint in this example is preset only via an analog input signal.

1	The setting for the profile must be made first; the IO profile is selected.	**[1.6 COMMAND]** [Cmd channels (CHCF)]: Terminals (IO)
2	The control-word, velocity and switchover sources can now be selected from those available. Switchover takes place via input LI6.	**[1.6 COMMAND]** [Cmd channel 1 (Cd1)]: Terminals (ter) [Cmd channel 2 (Cd2)]: HMI [Ref.1 channel (Fr1)]: AI2Ref [Cmd switching (CCS)]: LI6

Continued on next page

ATV71
IO Profile
Contd.

3	Now the individual ATV functions must be assigned to the individual bits in the switch (type CDxx). The inputs (LIx) and bits are linked automatically. • Bit 0 / LI1: Forward • Bit 1 / LI2: Reverse • Bit 2 / LI3: Fast stop • Bit 3 / LI4: Ramp switchover	**[1.5 INPUTS/OUTPUTS CFG]** [Reverse (rrS)]: CD01 **1.7 APPLICATION FUNCTIONS]** [Fast stop (FSt)]: CD02 [Ramp switching (rPS)]: CD03 **Note:** In the IO profile, forward is assigned to bit 0 automatically for two-wire control.
4	For feedback from the variable speed drive, data can also be assigned to the two digital outputs in the "Inputs/Outputs" ("I_O") menu. The variable speed drive fault message is assigned to the first output by default.	**[1.5 INPUTS/OUTPUTS CFG]** [R1 assignment (r1]: VSD fault (FLt) [R2 assignment (r2]: Frequency setpoint reached (SrA)

Note

These parameters represent a minimum configuration in order to be able to run the drive and the motor connected to it safely. Depending on the application, other parameters such as those associated with the configuration of the inputs, the setting of the ramps or the use of preset frequencies can also be modified in the same way. If these parameters are also to be modified from the application, they must be written accordingly as I/O signals.

Lexium 17

Introduction

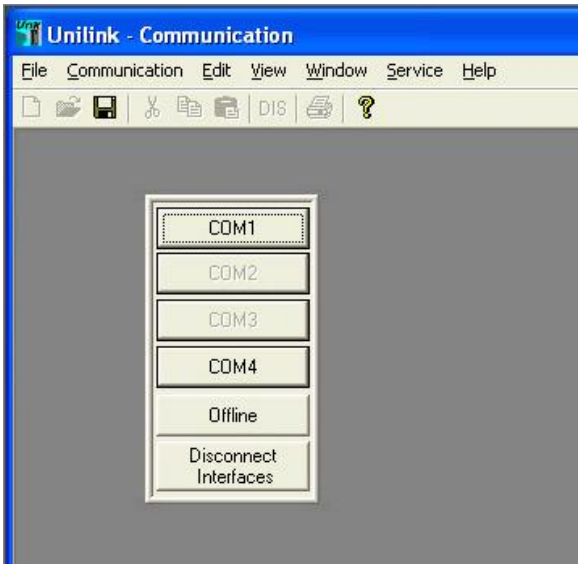
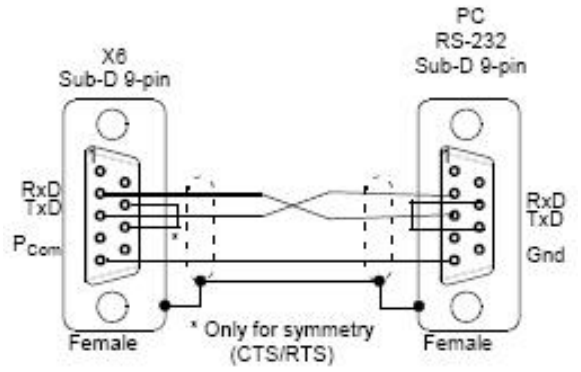
The settings on Lexium 17D servo drives can be made using the buttons on the front of the device and in the UniLink software tool.

In this application, by way of example, motion tasks are transmitted from the PLC to the servo controllers via the Sercos bus to demonstrate the interplay between servo and PLC. The following motion tasks are dealt with in the application:

- Move to new position data
- Move at a given velocity

The sequence outlined below is based on the controller being online, i.e., when there is a connection between the controller and the software and the configuration is made directly. Offline mode can also be used, although the text on buttons, etc., will vary.

Configuration with Unilink

1	When the software starts up, the Communication dialog box appears. You will see a list of interfaces. Some will be enabled, others not. Select the appropriate interface, e.g., **COM1**, to connect to the Lexium drive. (The COM1 port on the computer must be connected to the X6 port on the Lexium or to X6A on the CANopen splitter interface.) The figure opposite shows the cable assignment or layout (part number: **AM0CAV001V003**).	 

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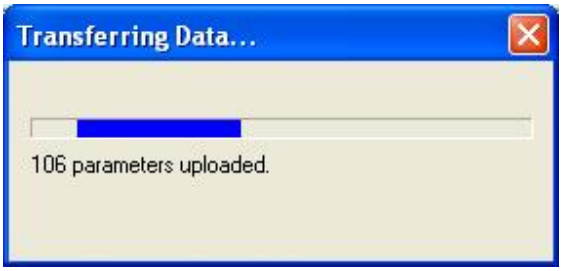
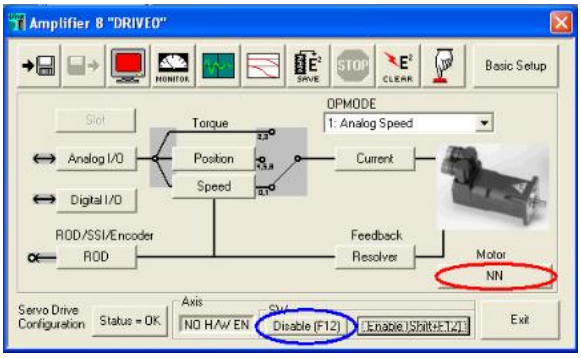
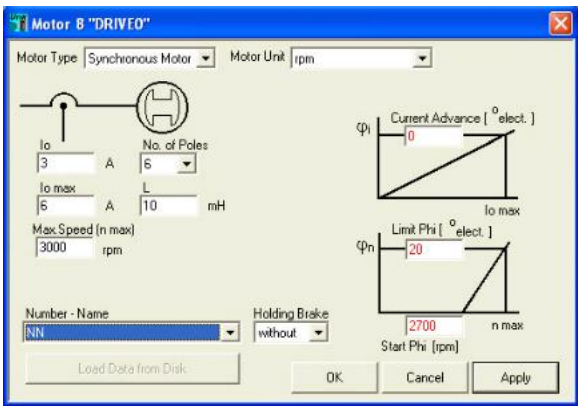
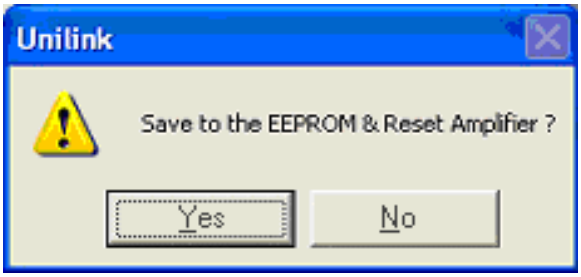
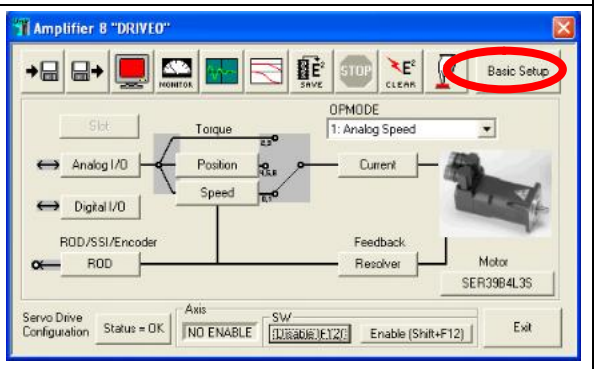
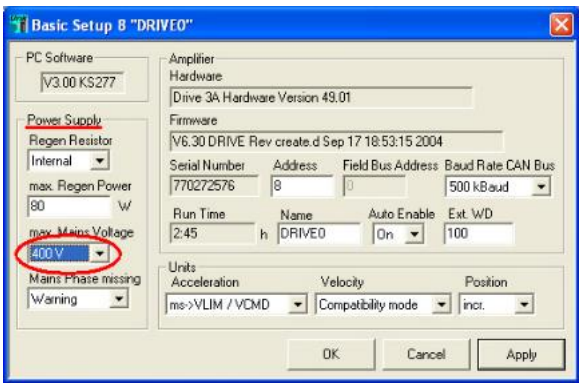
Configuration with Unilink
Contd.

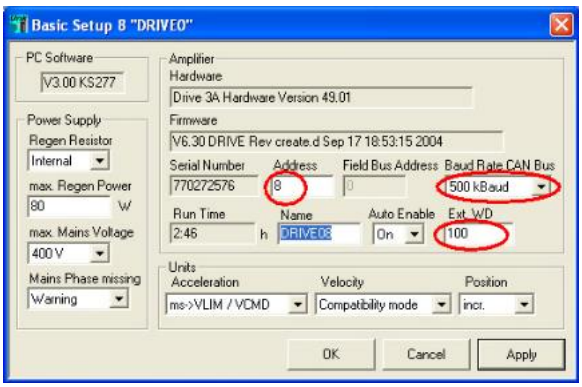
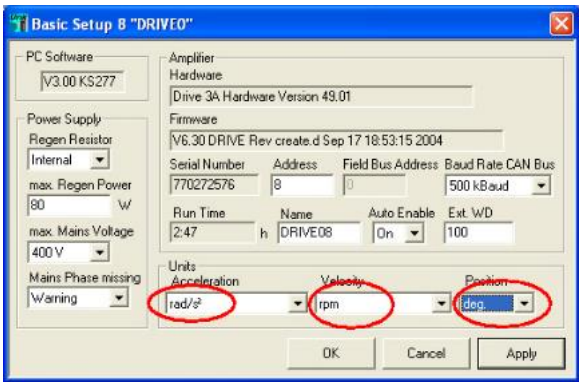
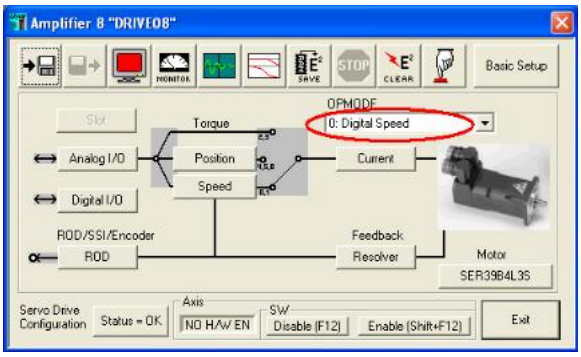
2	Once communication has been activated, the device will read the parameters.	
3	Once the parameters have been uploaded, the basic screen will appear with the relevant data. If the device has not yet been parameterized, a motor will not yet have been configured. In order that even basic settings can be made, the motor must not be enabled. It can be disabled by clicking on "Disable (F12)" (circled in blue). You can now continue to configure the motor by clicking on "NN" (marked in red).	
4	The motor data are taken from the rating plate. No other information is required for all drives listed. Select the correct motor from the list (e.g., SER39 B4 L3 SR).	
5	It is not clear from the motor type whether or not the drive has a holding brake. A corresponding prompt will, therefore, appear. The example motor does not have a holding brake.	

Continued on next page

Configuration with Unilink Contd.

6	As the changes made are fundamental settings for the amplifier, the data must first be saved and the amplifier reset.	
7	The connection is lost during the reset. To continue with parameter-ization, you will need to reconnect.	
8	Once communication has been resumed, click on **Disable** again to activate the input of basic settings. Then click on **Basic Setup**.	
9	In the Basic Setup screen, settings must/can be made in the fields with a white background. Under "max. Mains Voltage" (blue), you should select the max. line voltage (in this case 400 V). The response of the servo to a power supply failure ("Mains Phase missing") can also be selected here (in this case Warning).	

Continued on next page

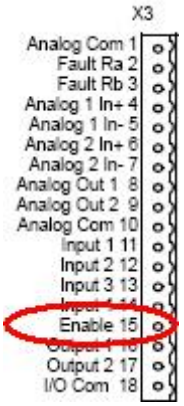
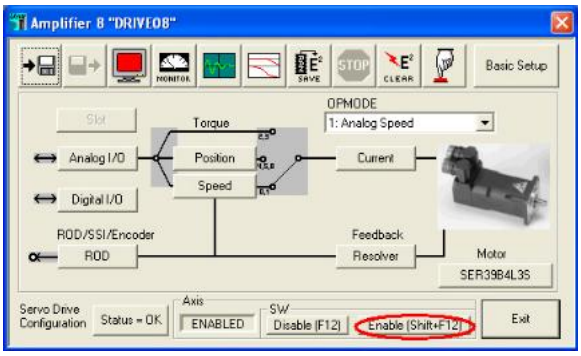
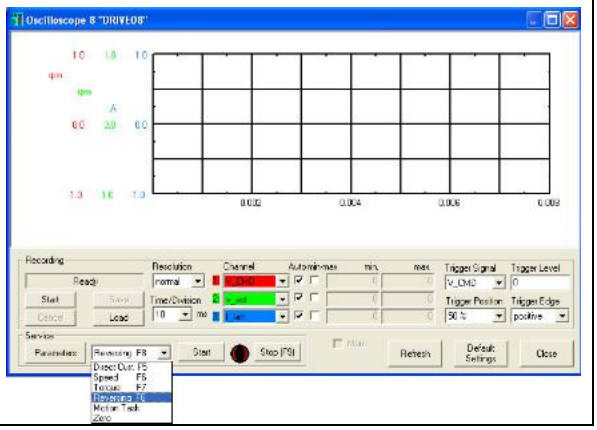
10	For Sercos communication with the PLC, the address and watchdog ("Ext. WD") need to be entered under **Amplifier**. In the application, addresses 5 to 8 are used for the four amplifiers. Entering a name for the amplifier makes it easier for the user to identify the device. The units can also be selected according to the task.	 
11	The Sercos bus settings must also be made on the basic screen. In order for the button to be enabled, the Sercos card must be present in the amplifier.	
12	In the Sercos settings the address is fixed according to the settings made above, so only the baud rate and the overall bus length need to be specified.	

Continued on next page

Configuration with Unilink Contd.

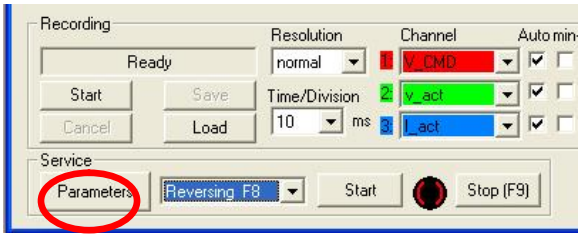
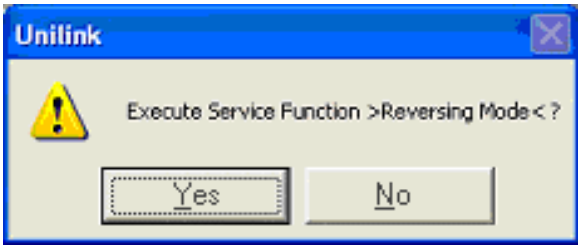
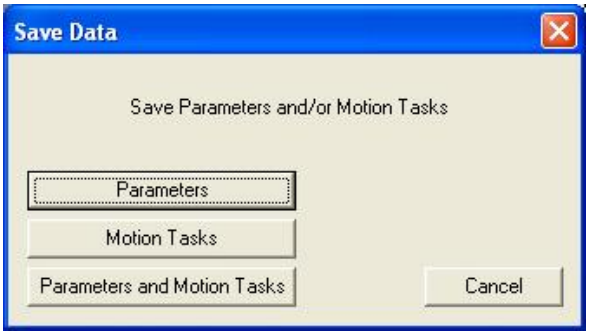
13	These settings now need to be saved in the amplifier by clicking on the icon opposite. The device does not, however, need to be reset.	

Startup with Unilink

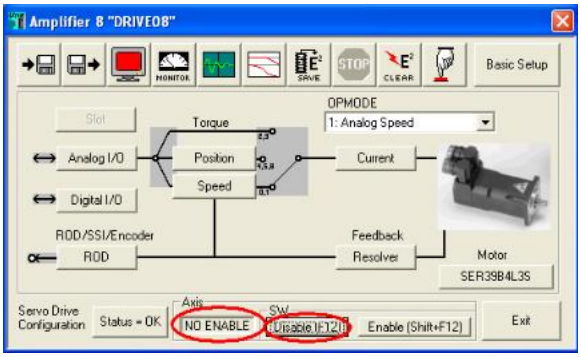
1	If the motor and amplifier have been connected using power and feedback cables, the drive can be started up via Unilink.	*Please be sure that the motors are running off-load, in order not to put personnel and machinery at risk.* *(For more information, see the safety instructions in the servo-component manuals.)*
2	In order that the function can be controlled via the software, the external conditions must be set. To do this, connect a 24 V power supply to the "Enable" hardware contact at terminal 15 (X3), which is associated with the connection and enabling of the power supply, and connect a 0 V supply to terminal 18. You will also need to activate the "SW-Enable" in the software. The drive is supplied with power and you will hear it switch to position control.	 
3	Click **Oscilloscope** to open the oscilloscope window, which enables individual values to be entered quickly and easily. It is also possible to control the drive via Unilink in this screen, and this is what we are going to do here.	

Startup with Unilink, continued

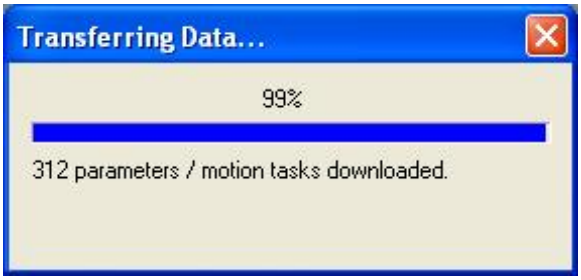
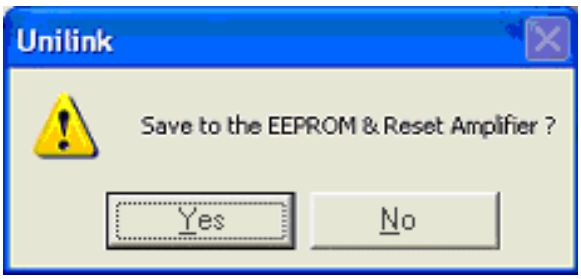
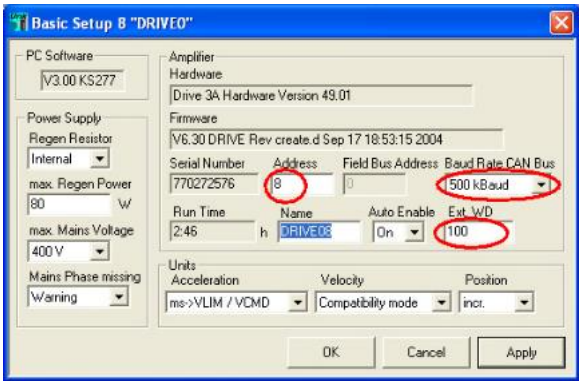
Startup with Unilink
Contd.

4	For speed mode, the best way to test the function is to use reversing mode, which can be selected in the bottom left-hand corner. The direction of rotation will be inverted at specific intervals. The parameters can be set on a drive-specific basis by clicking on **Parameters**. Click **Start** to activate reversing mode and **Yes** in the dialog box that appears next to enable it.	 
5	Once the function test has been completed, the settings made can be saved by clicking on the floppy disk icon in the main screen. Select **Parameters and Motion Tasks** in the next dialog box. We recommend that you use the drive names you assigned in Basic Setup when saving data.	 

Duplicating Other Drives

1	If the motor/amplifier configuration is the same, the data can be downloaded from a file to the drive. Neither a hardware enable nor a software enable is required (Disable/F12). If the drive has been set to **NO ENABLE** (circled in red), the floppy disk icon will no longer be disabled and can be invoked. Once you have selected the required file, an info box will appear, in which you can specify that particular parameters (e.g., name) are to be overwritten.	

Duplicating Other Drives
Contd.

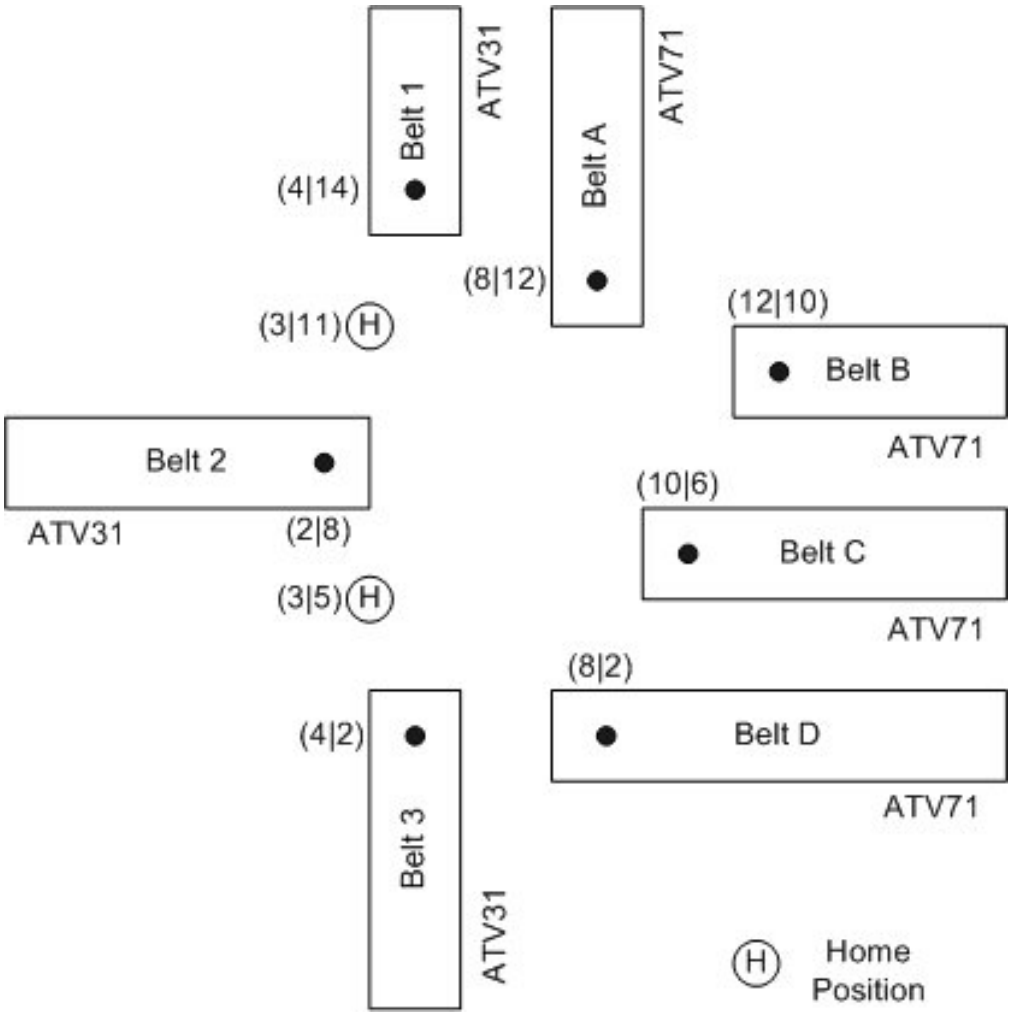
2	Once you have clicked on OK to confirm this message, data will begin to be downloaded to the drive.	
3	As the download brings about significant changes, the data in the amplifier must be saved and a restart performed.	
4	Following the restart, once the connection with the device has been re-established, the characteristic data for the Sercos bus and the device name will need to be checked in the Basic Setup screen. **Note:** The software enable must be reset in order to do this.	

Addendum

Description of the example program

The example program relates to two traveling cranes, which transfer packages from incoming belts 1 to 3 to outgoing belts A to D. Each traveling crane requires two servos, which execute movements in the x and y directions. The belts are driven by motors with variable speed drives (ATV31 or ATV71).

The first traveling crane works with belts 1, 2, A and B, while the second uses belts 2, 3, C and D. In the illustration below, the positions of the beginning and end of the belts are given as x and y co-ordinates in meters. The home positions of the traveling cranes are also shown.



Detailed components list

Hardware components – Group 1: Master switch				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
1.1	1	3-pin Compact master switch NSC100	28122	
1.2	1	3-pin terminal cover	28034	
1.3	1	230 V undervoltage release	28082	
1.4	1	Undervoltage release fuse and 230 V load contactor 1 A (type C MCB)	25020	
1.5	1	Alarm accessories 1 NC contact	29450	
1.6	1	Locking device	29370	

Hardware components – Group 2: Emergency off				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
2.1	1	Emergency-off switch with overload protection	XALK178-G	
2.2	1	Preventa safety relay	XPSAF5130	
2.3	1	Emergency-off safety fuse and 24 V load contactor 3 A (type C MCB)	25022	
2.4	2	Redundant load contactor 25 A 230 V control voltage	LC1D25P7	
2.5	2	Redundant load contactor 12 A 230 V control voltage	LC1D25P7	
2.6	1	ACK and safety indicator pushbutton activated	XB5AW-36B5	
2.7	1	Single-pushbutton housing	XALD01	

Hardware components – Group 3: Door safety				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
3.1	1	Preventa safety relay	XPSAF5130	
3.2	2	Door-safety switch	XCSA701	
3.3	1	Actuator for door-safety switch	XCSZ02	
3.4	1	ACK and safety indicator pushbutton activated	XB5AW-36B5	
3.5	1	Single-pushbutton housing	XALD01	

Hardware components – Group 4: Control components				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
4.1	2	Primary fuse 3 A (type C MCB)	25022	
4.2	1	Unity processor	TSX P57 3634M	
4.3	2	24 V DC 36 W power supply	TSX PSY3610	
4.4	2	Expandable backplane 12 slots	TSX RKY12EX	
4.5	7	Digital input module 16 inputs	TSX DEY16D2	
4.6	4	Digital output module 16 outputs	TSX DSY 16T2	
4.7	2	Analog input module 4 channels	TSX AEY414	
4.8	2	Analog output module 4 channels	TSX ASY410	
4.9	15	Terminal block for I/O modules	TSX BLY01	
4.10	1	Terminating resistors type A/B	TSX TLYEX	
4.11	1	Backplane connection cable	TSX CBY010K	
4.12	1	8-axis motion control (Sercos)	TSX CSY 84	
4.13	4	Outgoing fuse 6 A (type Z MCB)	26139	
4.14	4	Incoming fuse 1 A (type Z MCB)	26133	

Hardware components – Group 5: Magelis HMI				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
5.1	1	Fuse 1 A (type C MCB)	25020	
5.2	1	Magelis panel XBT-G 2330, 5.7", color, with Ethernet	XBTG2330	
5.3	1	Interface cable to Premium PLC	XBTZ968	

Hardware components – Group 6: 24 V power supplies				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
6.1	1	Three-phase fuse, 2.5 ... 4 A	GV2ME08	
6.2	1	400 V AC three-phase power supply, 24 V DC, 20 A	ABL7UEQ24200	

Hardware components – Group 7: Variable speed drives, servos and load components				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
7.1	11	Motor circuit breaker 6.3 A	GV2L10	
7.2	11	Auxiliary-switch attachment	GVAE11	
7.3	4	Variable speed drive 0.37 kW single-phase	ATV31H037M2	
7.4	3	Variable speed drive 0.75 kW three-phase	ATV31H075N4	
7.5	18	Load contactor 9 A, 24 V control voltage	LC1D09BD	
7.6	4	Lexium17 drive controller	MHDA1008N00	
7.7	4	Servo motor 0.6 kW	SER39A4L7SRAA	
7.8	4	Power cable, 3 m	LXACPAAA031	
7.9	4	Feedback cable, 3 m	LXACFACA031	
7.10	4	Sercos plug-in card for Lexium17	AM0SER001V000	
7.11	3	Sercos fiber optic bus cable 0.3 m	990 MCO 000 01	
7.12	2	Sercos fiber optic bus cable 4.5 m	990 MCO 000 01	

Software components – Group 8				
Item	**Qty**	**Description**	**Part no.**	**Rev./ Vers.**
8.1	1	Unity programming software XL V2.0.2	UNYSPUEFUCD21	2.1
8.2	1	Unity <> PLC programming cable	TSXPCX1031	
8.3	1	Magelis XBT-G programming software Vijeo Designer	VJDSPULFUCDV10M	4.2.0
8.4	1	Magelis programming cable	XBTZG915	

Component protection classes

Installation locations/protection classes			
Components	**In the field, on site IP 55/IP 65**	**Front IP 65**	**Control Cabinet IP 20**
Master switch NSC100			**X**
Emergency-off switch housing XALK	**X**		
Preventa modules XPSAF5130			**X**
Position switch XCSA	**X**		
Single pushbutton housing XALD	**X**		
Illuminated pushbuttons and lamps, all colors, flat		**X**	
Contactors, LC1, 230 V AC or 24 V DC, all ratings			**X**
Miniature circuit breakers, all types and ratings			**X**
Motor protection switches, all types and ratings			**X**
Phaseo power supplies 24 V DC, 20 A			**X**
Premium PLC components			**X**
CANopen taps with CAN cable			**X**
Variable speed drives, ATV31 230 V AC, single-phase all rating classes			**X**
Variable speed drives, ATV71 4000 V AC, three-phase all rating classes			**X**
Lexium17 drive controllers, 400 V AC, three-phase all rating classes			**X**
Magelis XBTG touch panel, all versions		**X**	

Component Features

Components

Premium PLC: TSX P57 3634M

A Premium PLC power base (3 Series) is used in the example, along with the associated modules for the inputs and outputs. The performance characteristics for the PLC (TSX P57 3634M) are as follows:

- 1024 digital I/O points, 128 analog I/O points
- 32 special modules (counter, axis control, etc.)
- Program memory: 192 kB (with PCMCIA card up to 1792 kB)
- 3 fieldbuses (Interbus, Profibus), 1 CANopen, 8 ASi encoders, 1 Ethernet
- Serial interface and built-in Ethernet link
- 5 programming languages (FBD, LD, SFC, IL, ST)

Sercos master module: TSX CSY 84

Master interface module for Premium PLCs with the following technical specifications:

- Control of 2 or 4 MBaud Sercos ring
- Control of axes
  - 8 real axes
  - 4 imaginary axes
- Control of axis groups
  - 4 groups for master/slave mode (2 to 8 axes)
  - 4 groups for linear interpolation (2 to 8 axes)
- Standard functions:
  - Electronic gears
  - Electronic cam disk
- Diagnostics
- Configuration via Unity Pro

Preventa safety relays: XPSAF5130

- Category 4 to EN 954 Part 1
- 24 V DC
- 3 safety-oriented switching contacts
- Slimline design

Continued on next page

Components
Contd.

Phaseo power supply unit: ABL7UEQ24200

- 400 V AC/24 V DC
- 20 A secondary
- Temperature range: - 10 to +50°C
- Parallel or series circuit possible (max. 2 devices)
- Short-circuit-proof and protected against overload

Altivar variable speed drive: ATV31H037M2

- 0.37 kW, 230 V AC single-phase
- Integrated class B EMC filter
- Temperature range: -10 to +50°C
- Velocity range 0 to 200 Hz
- Velocity control with flow vector check
- Operation via Modbus or CANopen possible
- 2 analog inputs plus 1 analog output
- 6 digital inputs
- 2 or 3 digital status outputs possible
- Protection of drive and motor
- Compact design, side-by-side installation also possible on a DIN rail using bracket VW3A11852

Altivar variable speed drive: ATV71H075N4

- 0.75 kW, 400 V AC three-phase
- Integrated class B EMC filter
- Temperature range: -10 to +50°C
- Speed range 0 to 1000 Hz
- Graphic display for control and parameterization
- Operation via Modbus, CANopen or other buses possible
- 2 analog inputs plus 1 analog output
- 6 digital inputs, 2 digital status outputs
- 1 shutdown output (emergency-off function)
- Expansion cards for buses, I/O, control
- Protection of drive and motor
- Compact design, side-by-side installation possible

Continued on next page

Components
Contd.

Lexium 17 drive controller:

- 3.6 A, 400 V AC three-phase
- 0.75 A, 24 V DC auxiliary voltage
- Output current 3 A (overload 6 A)
- Temperature range 0 to 40°C
- Built-in line filter with CE certification
- Regulation: Current: 62.5 µs; velocity/position: 250 µs
- Controller can be configured for all brushless servo motors
- Configuration and programming software with built-in oscilloscope function
- 2 digital inputs, 5 digital outputs; 2 analog inputs, 2 analog outputs
- Built-in serial and CANopen interface
- Expansion cards for communication, e.g., Sercos, possible

Circuit breaker: GV2L10

- 6.3 A
- Short-circuit protection
- Magnetic activation 33.5 A
- Lockable

Contact

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